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Electrical World

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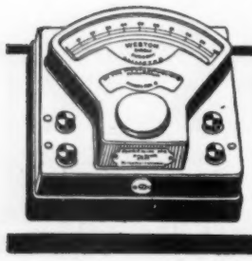

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Electrical World

The Consolidation of Electrical World, Electrical Engineer and American Electrician

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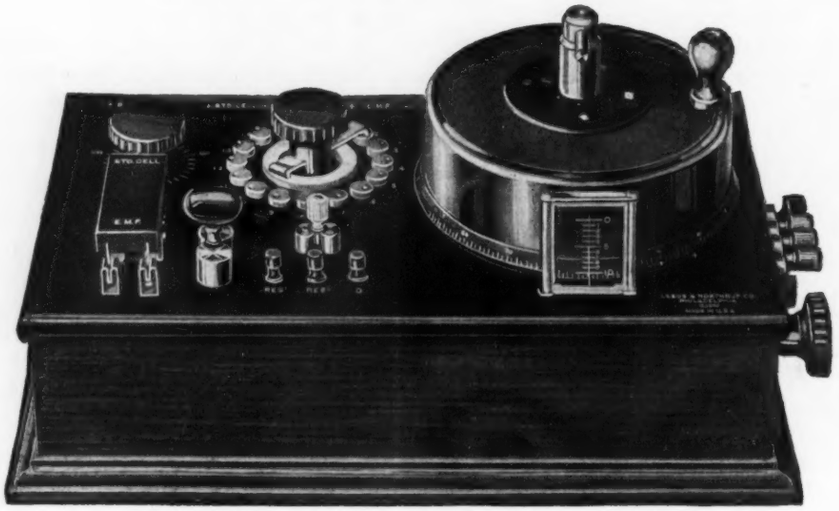

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Electrical World

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W. H. ONKEN, JR.
Editor

VOLUME 88 — *New York, Saturday, November 20, 1926* — NUMBER 21

Let Us Give Thanks for Stability

TO THE engineer and economist the high-minded address of President Coolidge at Kansas City on Armistice Day carried utterances scarcely less significant to business than to patriotic citizenship and international relations. It referred more than once to the prosperity of the United States and, with the speaker's well-known skill in expressing simply economic truths, declared the value of stability in this nation's business to the world at large. "While we do not need to boast of our prosperity or vaunt our ability to accumulate wealth," said the President, "I see no occasion to apologize for it." And again: "The fact that our position is strong, our finances stable, our trade large, has steadied and supported the economic condition of the whole world. Those who need credit ought not to complain, but rather rejoice that there is a bank able to serve their needs."

There is a lesson for the electrical industry in these words. Years ago this industry passed into the essential activities of mankind. It has prospered deservedly. Today its development is expressed in figures beyond the dreams of the pioneers; tomorrow who can comprehend its magnitude? With this growth has come increasing stability, and it is hardly an exaggeration to say that, outside our government obligations, its securities constitute an investment balance wheel of unparalleled value. Attacks upon it there will be, some invited by its very size, others by self-seeking and others by an honest desire to remedy defects resulting for the most part from its swift development; but in meeting such assaults and criticisms let there be no attitude of apology for prosperity, but manly pride in the ideals of leadership and service which have always been in the forefront of its progress, open-minded joy in the unfolding opportunities before it, and thankfulness for the stability which means so much to those whom it serves today and is to serve in the years to come no less than to the splendid army of men and women whose lives are dedicated to its tasks.

Depreciation Studies Are Important

TO MANY utility managers papers and addresses upon depreciation are "full of sound, signifying nothing." Discussion of this subject strikes many able executives as more or less futile and juiceless in interest. Yet the industry cannot escape the inevitable advance of depreciation, no matter how excellently maintained any property may be. Wear and tear may be cared for, but inadequacy and obsolescence are not to be eliminated by repair work, even though their climax may be long postponed by skillful engineering. Prosperity through expansion of business seems likely to continue for many years in the electric power industry, but it is none the less timely to improve studies of equipment life and to itemize costs better for ready reference in this connection.

Too many companies lack the basic data for any comprehensive analysis of the depreciation problem on their systems; too much is left to official "judgment" when rate and capitalization cases arise, and too often depreciation accounting is far from clear to the engineering mind. Entries in regard to retired property in many capitalization case exhibits are inadequate from the standpoint of an engineering audit, although a little more system in preparing such material for the regulative authorities would cost but a trifling sum and be well worth while. Wide as are the differences of opinion among utility men as to depreciation practice, it is time to attack the subject from a co-operative angle to which the engineer and the accountant each contributes one side. The former is in a position to evaluate definite life and cost data hitherto lacking on many systems, and the latter is qualified as an expert to articulate the facts and findings into the financial set-up and operation of the company. These are days of nation-wide interest in rate structures and their development, and even though many improvements in equipment can be financed out of their operating savings, it is dangerous to lose sight of the trend toward final disuse of much expensive plant in analyzing present and future capital and revenue requirements.

The Twenty-four-Hour Day the Goal

THE present trend of electric utility load factors is probably down, not up. The major increases in loads for the past twenty-five years have been due to more extensive and more intensive applications of electric power to industry. If a paradox may be forgiven, one might say that the increasing use of electric power in industry is limiting the use of electric power in industry. The condition can be more correctly stated by saying that the wider application of electric power operates to decrease the time period of its use. The application of electricity to processes of production in substitution for manual labor has the effect of increasing both quantity and quality of production, and consequently it decreases the time required for the production of a given quantity.

There is one final limit to production, and that is market saturation. The attainment of saturation has been predicted by various men for various products, usually much to the discomfiture of the prophet. But there is another limitation of production which becomes operative long before saturation impends. That is the rate of market absorption. Over a long time period industry can average only that rate of production that will correspond to the rate of market absorption. And if, as is true, electricity increases the rate of production, the time required to produce for a given rate of absorption will be lessened. Time is one of the determinants of load factor.

It is quite characteristic of social changes—and this phrase is only a synonym for economic changes—that they have already arrived when we think they are still on the way. This is as true of evolutionary changes as of revolutionary changes. The evolutionary change is not disruptive, or sometimes even perceptible, if all of the elements concerned in the change have moved in step. But if any element has remained stolidly fixed, that one is bound, soon or late, to undergo a swift and drastic process of conformation to the rest. Such forced conformations are usually uncomfortable. Because of its magnitude and also because of its infancy in comparison with other conditions of human life, which has not yet made it a deeply rooted factor in mass consciousness, the electrical industry is perhaps the slowest to take cognizance of the social change in which it is performing the principal part.

There is no lack of evangels even now crying in the wilderness and heralding the future. Every issue of this and of every other magazine that serves the electrical industry harps upon the necessity for increasing the domestic load. It is only by tying itself tighter and tighter to the twenty-four-hour living day of every individual in the country for three hundred and sixty-five days in the year that the central-station company can become less dependent on the ties that bind it to the workingman's eight-hour day for three hundred or fewer days in the year. For its own wellbeing and in performance of its duty to the civilization to which it is now so largely contributing, the central station must prepare itself for the changed social conditions that are imminent, that have perhaps arrived. The five-day week is here in the plant of the largest single producer in one of the major industries of the country, and past events bring conviction that this manufacturer is not departing from the path but is only leading the way. There are obstacles to the fullest development of the domestic load. The fixation of equitable rate structures and the necessity for large investments in both station and distribution capacities are the most formidable. There is danger that the time now being taken to contemplate these obstacles and consider the ways to get over or around them may be bitterly regretted as lost. While disputes have been waged over theories of attack and defense many a campaign has failed.

The Development of Electrical Appliances

IN THE editorial columns of the ELECTRICAL WORLD the suggestion was recently offered that a national appliance laboratory be established for the purpose of testing and approving electrical appliances. Such a laboratory would indeed be a powerful influence toward the development of electrical appliances along lines which would insure the greatest satisfaction to the user. Its analyses would undoubtedly keep out of the central-station-company merchandise departments appliances with cheap cords, faulty connections and other features of improper construction. It could also furnish to the central-station companies reputable and reliable figures as to the energy consumption of appliances under average conditions of use and the basic data with which to demonstrate to the public the over-all economy of electrical conveniences.

Another function which might be exceedingly useful would be the development of new lines of electrical devices. Those who are familiar with the activities of the refrigeration committee of the Commercial Section of the National Electric Light Association over a number of years past will quickly recognize the tremendous usefulness such laboratory would have possessed had it been available during the period of the most rapid development of the domestic electric refrigerator. A device that is perhaps in somewhat the same stage today that the electric refrigerator was in a few years ago is the motor-driven oil burner for house-heating purposes. Literally hundreds of these are being placed on the market, and the central-station sales manager who considers taking on the sale of such a line of apparatus is immediately confronted with dozens of claims for superior construction, economy of installation and operation.

Here is an opportunity for the newly awakened consciousness of the commercial men of the N.E.L.A. to put into tangible form a co-operative undertaking which would be of distinct assistance to the industry in molding its development along the proper lines.

Management Problems of Research

CHARACTER analysts say that managerial ability is distinct from other abilities, so that, for example, a poor salesman may become a first-class sales manager —or, as a college president once put it, "we lost an excellent professor and acquired a poor dean." Yet there are differences in managerial aptitudes as well, and a big-fisted Irishman who can handle a gang of track laborers without any trouble and be beloved by them may not be able to manage a tiny temperamental opera star at all, any more than a department-store manager could guide the destinies of a governmental scientific bureau. Our electrical manufacturing and operating industry, in common with other industries, requires larger and larger centralized staffs of highly specialized technical experts, and the problem of their proper management looms bigger and bigger in the minds of its leading executives. Not that these scientists and engineers are cantakerous or mercenary. On the contrary, they are mostly meek and docile, and after a few years of specialized work many of them are too much at the mercy of the employing corporation even to be able to quote the Bible about the laborer being worthy of his hire.

No, the problem is not one of keeping them well behaved, but one of preserving their inspired mood. In this respect the manager of a high-grade research laboratory has nothing to learn from the manager of a traveling long-haired virtuoso. A machine-tool operator, with proper instructions and strict inspection, can turn out about the same number of satisfactory pieces per day, whether he feels buoyant or is sorry that he was ever born. A researcher, on the other hand, is expected to see what others before him have been unable to see. He is expected to exercise infinite pains, to co-operate with every one within reach, to attend to his own education and development in his spare time, and to know how to strike a happy balance between a thorough fundamental inquiry and getting immediate results. He must learn to acquire depth without losing breadth. He looks to the manager not as to a boss to prod him along (most researchers are

apt to overwork anyway), but as to one to assist him in getting the necessary materials and help, to rejoice with him in his success, and to console him when a pet scheme, after years of persistent effort, finally fails to work.

Consider three types of research managers—the "never was" type, the "has been" type and the "is" type, meaning respectively a person who never was an investigator himself, one who started as a scientist and then drifted into administrative work, and one who is still carrying on some individual research. The first type has to go entirely by guess as to what is best, the second is handicapped by the "in-my-time" attitude, and the third is apt to neglect managerial duties or to impose his own views too much.

Far be it from us to suggest a universal solution, but it looks as if in the present praiseworthy endeavors to connect science and industry two factors must not be forgotten, to wit, that research workers within an industrial organization must be properly managed and that the principles of such management are quite different not only from those obtaining in a foundry, but even from those found in a high-grade engineering department.

Cable Joint Failures Affected by Sleeve Shape

ONE of the common locations of failure of high-voltage underground cables is at the joint between cable lengths. These joints have to be made after the cable is installed and by hand; thus there is a discontinuity of both materials and workmanship, and also the likelihood of the inclusion of both air and moisture in the insulation, which is supposed to be free of both. Very elaborate precautions are taken for the elimination of air and moisture, and it is commonly assumed in case of trouble that one or the other of these undesirable elements is present.

A paper by F. Loebner in a recent issue of the *Archiv für Elektrotechnik* describes a study of the influence of the size and shape of the usual enlarged sleeve of the cable joint in its bearing on the value and direction of the internal potential gradients. After the conductors are joined it is a common practice to apply paper in the usual horizontal layers, tapering the paper off at the ends so as to conform to the proposed final shape of the outer sleeve, which is finally filled with compound. It is known that the breakdown strength of impregnated paper parallel to the layers of paper is much less than it is perpendicular to the paper. The article in question calls attention to the shape of the conical end of the sleeve in its bearing on the relative values of the two components of the electric field parallel and perpendicular to the paper layers in contact with or near the sleeve.

The exact theoretical analysis for different shapes of sleeve has apparently never been accomplished, but the author finds a close approximation in the parallel plate condenser with one plate smaller than the other, as investigated by Maxwell. Curves are drawn showing the distribution of potential gradient for different shapes of sleeves. It is surprising to find how high may be the values of the component of the gradient lying along the paper. The article also reports some experiments on the breakdown strength of cables with different shapes of end bell. The variation of breakdown strength between the case of a lead sheet cut off square and one provided with a flaring end sleeve of good shape was found to be from 30 kv. to 80 kv. through several intermediate shapes of sleeve. These facts suggest that there may be a simple explanation for many cable joint failures, and it is particularly encouraging to note that it should be possible to avoid such trouble by a proper selection of the shape of the sleeve and of the method of applying the underlying paper.

Lighting Beneath the Sea

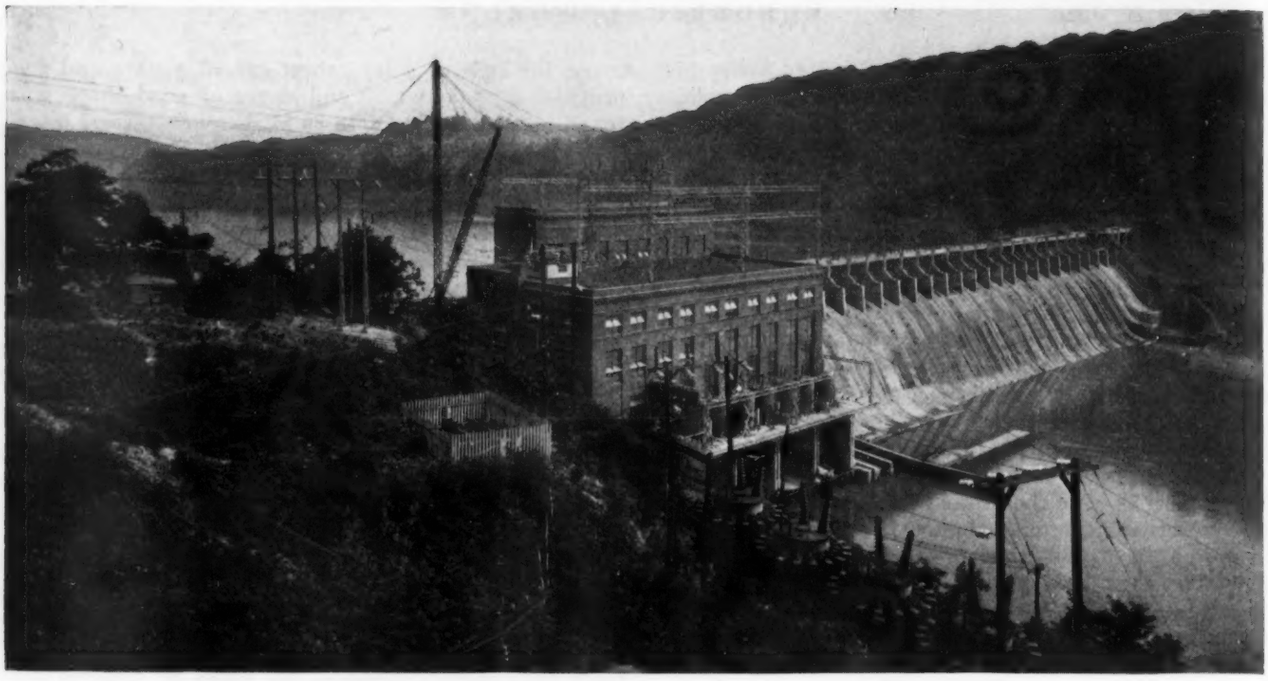
ELECTRIC light has conquered darkness wherever man can normally live. Night flying is made practicable by the use of beams of artificial light. Underground operations of all kinds have long been carried on by artificial light. Least has been done with light at appreciable depths below water. Perhaps this is due partly to the increased difficulties which immersion in water presents. However, it is probable that the lack of development of "deep-sea" lighting has been chiefly due to lack of demand for it. Of course, swimming pools have been illuminated for years by under-water equipment, and many other applications of the same order have been made. But the attempts at deep-sea illumination have been comparatively few and sporadic. Motion pictures have been taken under water for a number of years, but this has been done from behind a plate glass near the bottom of a large vertical tube sunk into the water. Combinations of telescopes and lighting units have been tried.

In recent years several applications of electric lighting have been made in salvaging operations which show such lighting to be feasible. The most recent of these was in connection with the exploration of the submarine S-51 before it was raised to the surface. Great pressures of water and the deleterious effects of salt water are the chief difficulties. However, these have been successfully overcome by strong metal and glass housings and special precautions in regard to insulation. There appear to be many possibilities of under-water illumination, besides salvaging and scientific studies of the sea bottom by means of artificial light and photography. Lighting of the bottom of bathing areas in the interest of safety and the finding of the bodies of drowned persons would seem to be feasible. Artificial lighting has conquered many difficulties, and under-water lighting will some day be commonplace.

Sales the Guide to Buying

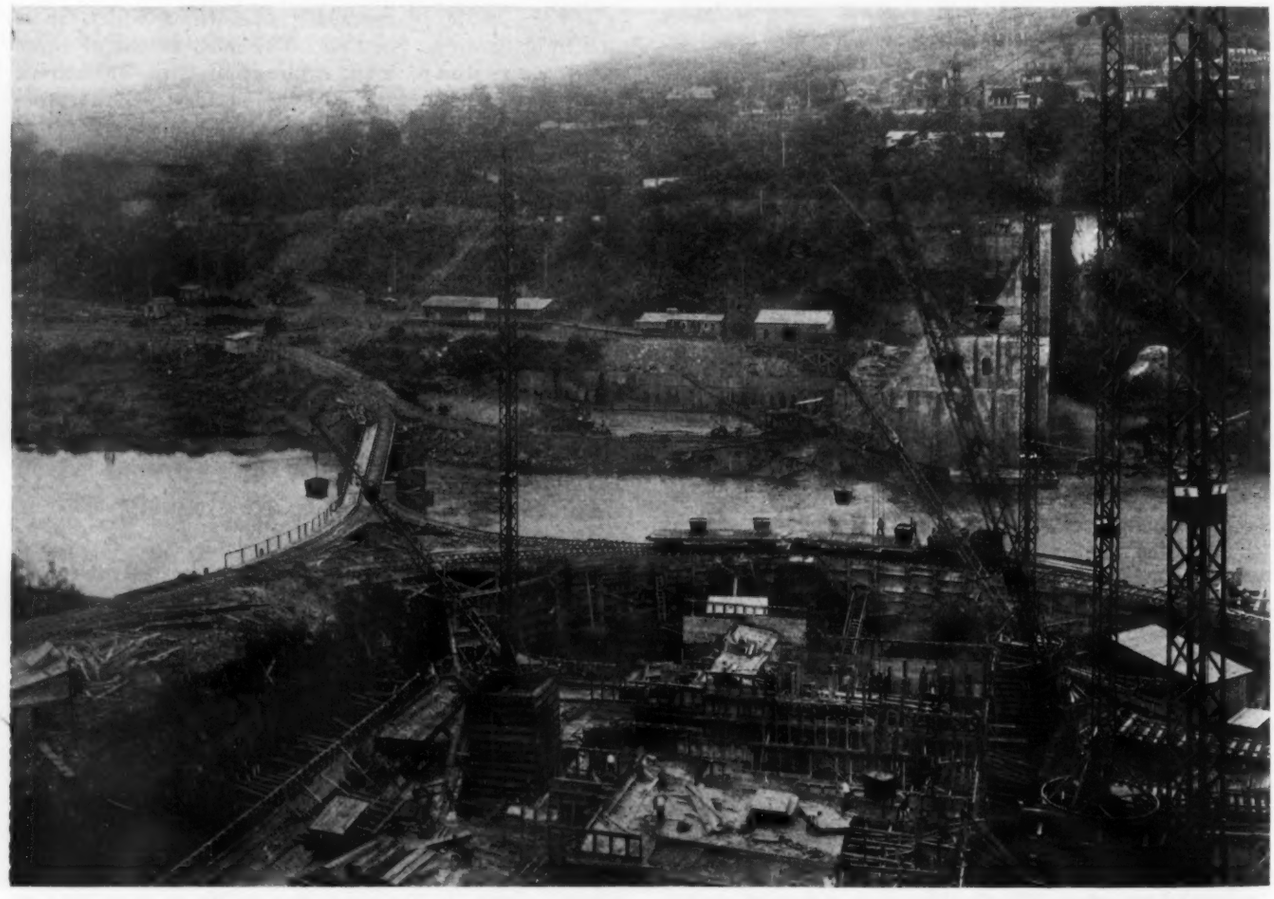
IF MERCHANDISE had fixed value, the shrewdest buyer would be he who secured the largest discount. But merchandise values are not fixed; merchandise is worth what it will sell for at a given time less carrying charges until sold. This fact is but vaguely grasped in the electrical industry. Many dealers clamor for discounts when what is needed is sales. They confuse spread with profit and forget turnover. Some even regress finally to such a moronic state that they seem unable to differentiate between a single hundred-dollar bill and seven twenties.

Buying merchandise is no job for a purchasing agent. It is the job of a salesman. The cash register, not the discount sheet, is the only true guide in merchandise buying.



Peak-Load Cheat Haven Plant of West Penn Company Completed

THIS peak-load hydro-electric station of the West Penn Power Company, containing 16,000-kva. units serving 132-kv. transmission lines, was started June, 1925. By December of that year the dam and power-house structure were completed and the pond filled. The first unit was delivering energy June 1, 1926, and the fourth in September.



Standardization Principles in

Substation Design and Construction

Objects and Applications of Standardization of This Class of Work—Its Advantages and Its Limitations—Minimum System Cost the Desideratum—Experiences in Practice

By M. L. SINDEBAND and PHILIP SPORN
American Gas & Electric Company

THE object generally sought by standardization is reduction of cost or reduction of effort in carrying out a certain piece of work. Reduction of effort usually is sought to reduce cost; hence it can be reasonably stated that reduction of cost is the prime object of standardization.

Cost in this connection, however, must not be construed in any narrow sense. It must be understood that it is total cost, so that in a particular case it may mean cost to a large group as a whole as distinguished from cost to an individual in the group. In the case of substation construction, for example, an analysis of reduction of cost should embrace the factors of planning, design, construction and operation. Any attempt at standardization that does not take all these factors into account is bound to fail.

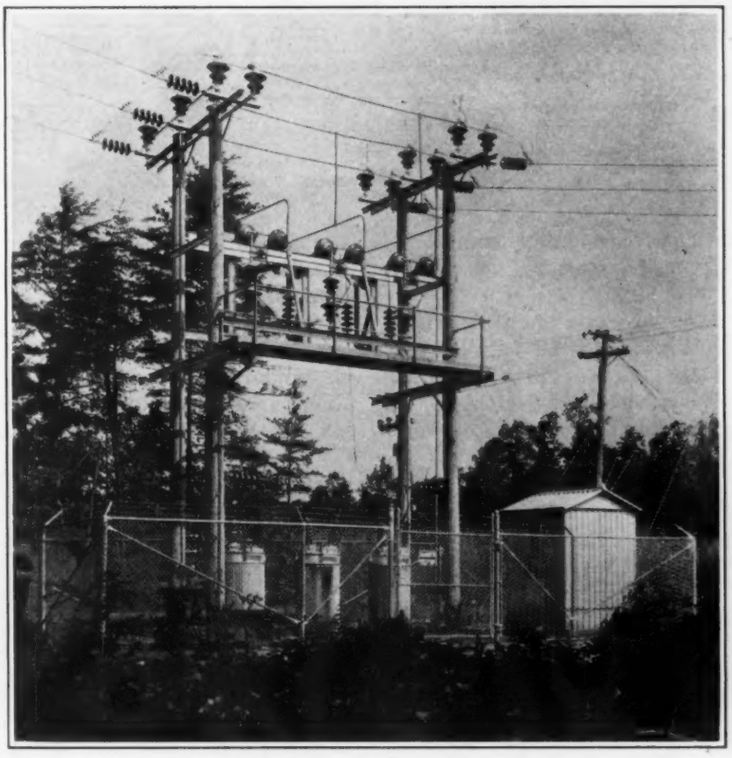


FIG. 1—AMHERST SUBSTATION OF APPALACHIAN ELECTRIC POWER COMPANY

Viewed from this standpoint, it is quite possible that a standardized substation, when applied to some individual installation, may contain more steel than another substation that might have been designed for the same work. Yet the standardized substation may be the cheaper one of the two; if for no other reason, because of the fact that in all probability it took a few weeks less time to design it and get it on the job than the specially designed station, and the additional revenue obtained in cutting in the service to the consumer that much sooner more than offsets the value of additional steel.

Standardization among the electric light and power companies has been applied very widely to distribution and even to transmission work, but when it comes to the question of substations, doubt is often expressed as to the possibility of carrying it out in this particular field. However, it must be admitted this occurs generally only in cases where the amount of work involved is not large enough to make an acute problem. An engineer who would not dream of solving every distribution installation on an individual basis and has standardized all his installations and turned them over to the distribution superintendent will very often feel constrained to exercise his individual or artistic inclinations on every substation job that comes along. Where, however, the engineer is faced with the problem of what, for the lack of a better term, may be called quantity production, as is the case with those who handle work for large holding companies, standardization becomes an absolute necessity. The only alternative is a limitless engineering force that would move with such ponderous slowness that the cost of engineering not only would become prohibitive but would at the same time nullify its value.

STANDARDIZATION OF SUBSTATIONS CAN BE HAD

The problem then is: Can standardization be applied to substation design? The answer on the basis of the writers' experience is a decided affirmative. To carry out standardization in the case of substations may involve a greater variety of standards than would be required perhaps in some other lines of work. It may involve greater care in selection and application of the standards, but this holds to a greater degree in almost every application of standards. Above all it will involve willingness to modify or break away from a standard if

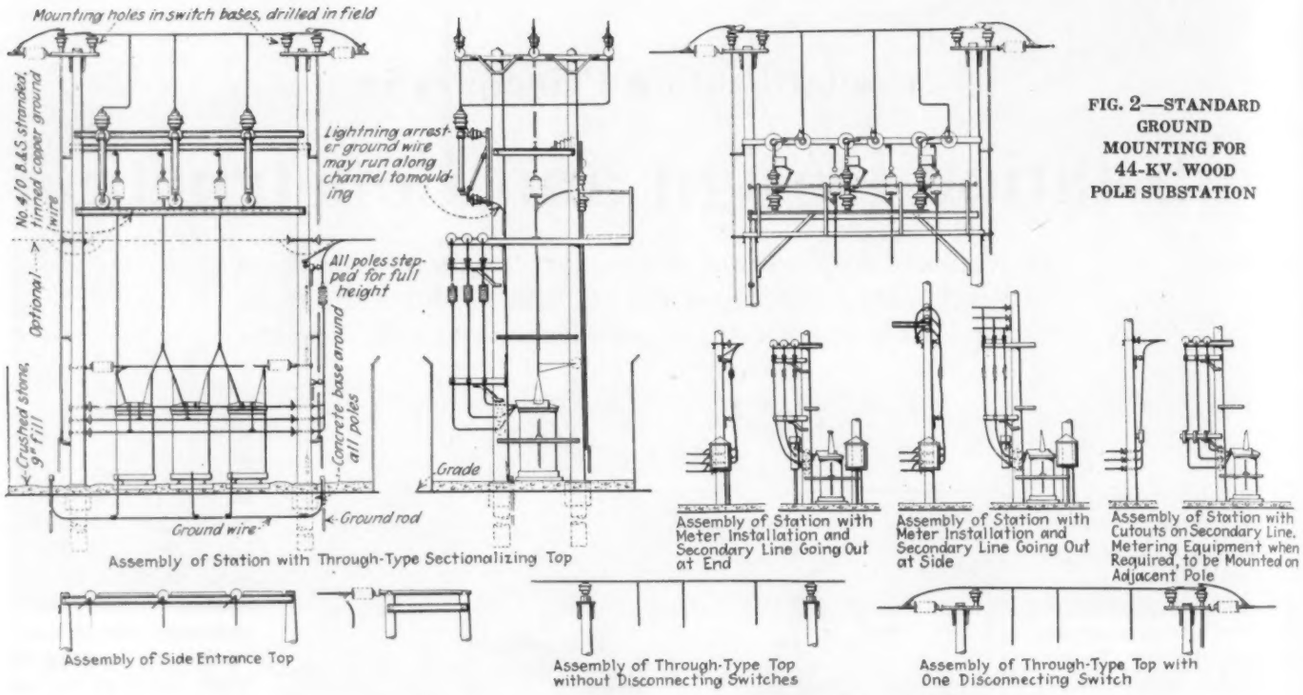

Mounting holes in switch bases, drilled in field
No. 4/0 B.&S. stranded tinned copper ground wire
Optional
Crushed stone fill
Lightning arrester ground wire may run along channel to moulding
All poles stepped for full height
Concrete base around all poles
Grade
Ground wire
Ground rod
Assembly of Station with Through-Type Sectionalizing Top
Assembly of Station with Meter Installation and Secondary Line Going Out at End
Assembly of Station with Meter Installation and Secondary Line Going Out at Side
Assembly of Station with Cutouts on Secondary Line. Metering Equipment when Required, to be Mounted on Adjacent Pole
Assembly of Side Entrance Top
Assembly of Through-Type Top without Disconnecting Switches
Assembly of Through-Type Top with One Disconnecting Switch

FIG. 2—STANDARD GROUND MOUNTING FOR 44-KV. WOOD POLE SUBSTATION

it does not apply in a particular case. But granted all these, standardization can most assuredly be worked out successfully.

Start, for example, with an average substation. In connection with it you have first the engineering. A given substation has to be erected along a certain transmission line to supply a given load, which will be handled in turn by a certain number of transformers. The substation in addition must have certain protective features. It is to handle a certain number of high-tension lines, a certain number of low-tension feeders and so forth. The problem of first estimating and visualizing the substation is very much simplified if a group of standards exists. Certainly, in the process of planning, an actual standard that has been completely drawn out and has perhaps been already built helps greatly.

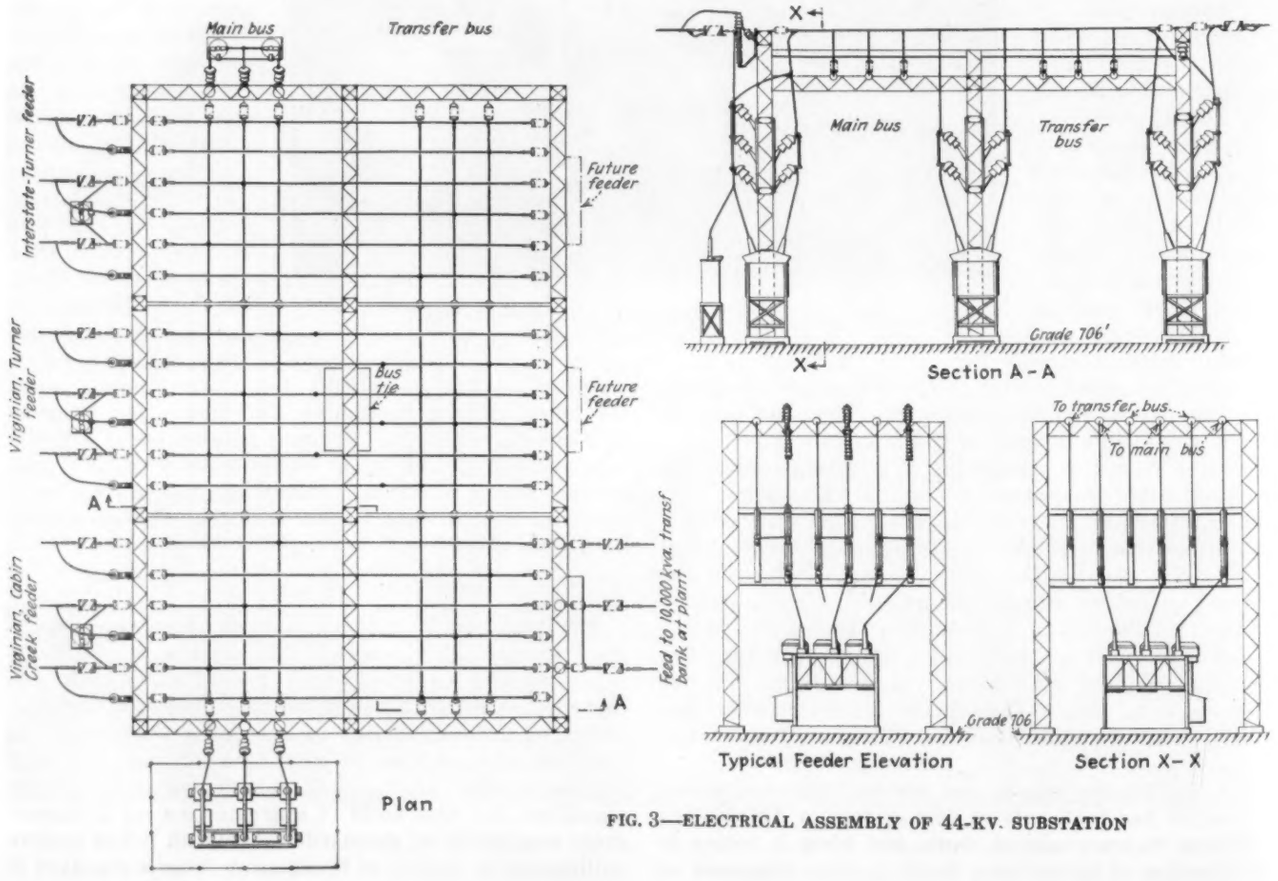


FIG. 3—ELECTRICAL ASSEMBLY OF 44-KV. SUBSTATION

If the estimate that has been prepared is approved by the authorities in charge of granting appropriations and it becomes necessary to proceed with the substation, if it is a standard station, the amount of further engineering in connection with it will be comparatively small.

The engineering on a particular station having been carried out, the material has to be ordered. If the station is a standard substation, the delivery of this material can be very much expedited, since it is possible to order the material before the drawings are adopted or put together. Likewise it makes it possible to order certain materials in larger quantities and even makes possible stocking other items, resulting both in lower costs and in quicker delivery. A further advantage, not to be overlooked, is the question of interchangeability of material. If, for example, a certain substation is planned for one locality and it is found later on that the substation is not needed so badly as another substation in another locality, where standardization exists, it is possible to remove available material temporarily from one substation site to another and again gain advantage in time.

Aids Construction Work

From the construction standpoint standardization again has many advantages. In the first place, the bills of material for many substations are bound to have great similarity and in some cases will be exact duplicates. After a certain number of substations have been built in accordance with these, any inaccuracies or deficiencies in bills of material are bound to have been cleared up, so that by the time the standard becomes established it is pretty definitely known that the existing bill of material is complete. In the case of material that involves fitting together, such as steel, it is very certain that all details have been checked on the basis of actual experience, so that unless workmanship is far below standard they are bound to fit readily. The construction men, too, in a certain locality, after handling a number of substations of a certain standard, become familiar with the design and know exactly what it has to look like and therefore can go about repetitions of the job with greater speed and precision.

Methods of Carrying Out Standardization

It is apparent that, after a decision has been made to standardize, a beginning must be made somewhere. The first and most important step of standardization is the rationalization of procedure. This is the real basis of all standardization. For example, take the simple matter of transformers for a very small station; a 300-kva. station stepping from 33,000 volts to 2,300 volts. Such units could conceivably be placed in a substation on a platform, or they could be placed on the ground; they could be connected to the line by means of an ordinary disconnect switch, or by means of a horn break switch; they could be tied in solidly, or they could be connected through a high-tension fuse; the low-tension side could be connected through an expulsion fuse, through an oil cutout or through an oil switch. The high side could be left unprotected, or it could be protected by a station type arrester or through a distribution or pole type arrester. If the station is one of a series on an isolated transmission line, the two sides of the line could be sectionalized at the station, or they could be carried through solid; the station itself could be made of wood, it could be made of wood and steel, or it could be made a totally steel structure. Now, unless all these points of variation are brought down for solution to some rational basis, standardization might as well be given up.

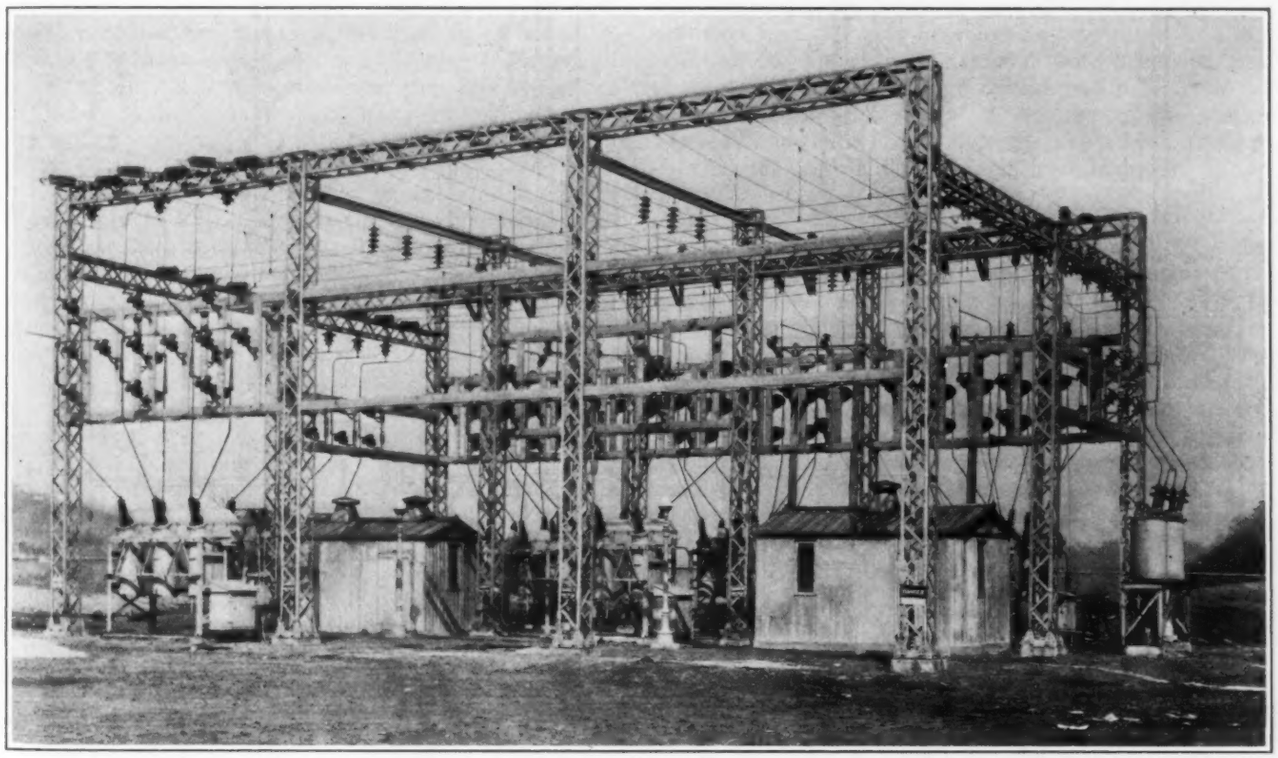


FIG. 4—CAPITOL HILL SUBSTATION OF APPALACHIAN ELECTRIC POWER COMPANY AT CHARLESTON, W. VA.

The next step is, of course, the developing of the tools of standardization—the drawings and bills of material. In this respect, after standardization is established the thing to do is to tackle those cases that you use most and then tackle those that are next in point of use and so on, until finally you reach a point where it becomes necessary to weigh carefully the possible frequency of use of a standard against the labor involved in establishing it. Such standardization cannot, of course, be carried out within a few weeks or a few months, but is bound to be of slow growth. Its development for any particular organization or any particular field is bound to be dependent to a great degree on many local conditions, such as the amount of work handled, the number of men available to take care of the work, etc. No matter where application is attempted on this branch of electrical utility work, it will invariably be found that probably greater effort is involved in attempting to cover the field in this particular branch than in a good many other branches, the reason for this being the great variety of combinations that are present and the different types of substations needed to cover the field.

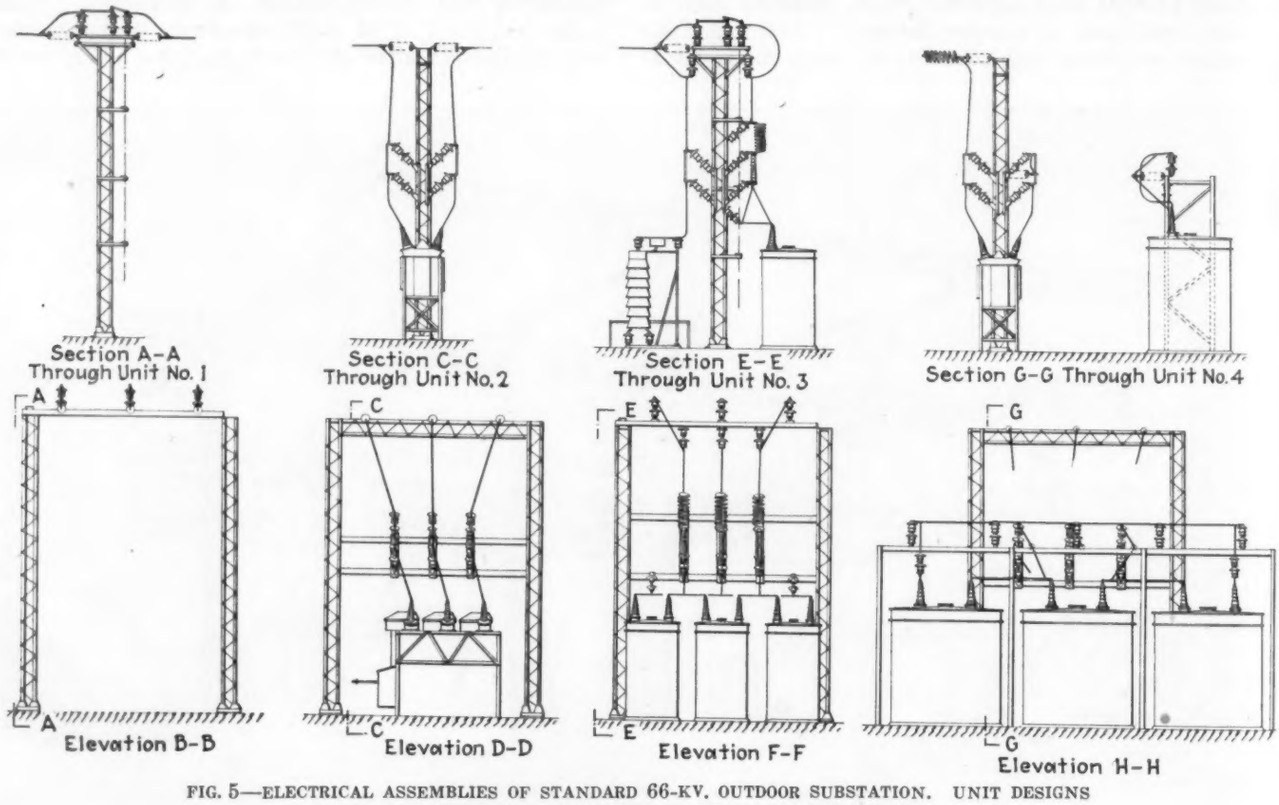


FIG. 5—ELECTRICAL ASSEMBLIES OF STANDARD 66-KV. OUTDOOR SUBSTATION. UNIT DESIGNS CAN BE ASSEMBLED FOR COMPLETE STANDARD SUBSTATIONS

VARIETY IN STANDARDIZATION OF SUBSTATION WORK

It has just been pointed out that in working out a standardization scheme for substation work a great variety of designs and drawings may be needed if the work is to be carried out properly. The easiest way of doing that, naturally, would be to work out a design for every possible combination. This is not always necessary. It is true that certain types of designs will best be taken care of in that manner. Other types, however, can be better taken care of in another way.

For example, Fig. 2 shows a standard design for a 44-kv. station and Fig. 1 shows an actual substation built from this design. Such a design obviously has its application for grades of service where permanent steel installations are not warranted and is limited further in the size of transformers that can be handled on it. The design has certain points of flexibility, but these are again limited. With these exceptions, the substation is a fairly staple article, and granted a location where it is applicable the drawings and the bills of material can be picked from the files and the job engineered with very little special work.

It is apparent that stations of this type can most easily be taken care of by working out a complete and separate design for various classifications and by actually covering each major variation with a separate design.

As the size and possible elaborateness of the station increases it is obvious that the number of combinations that could be carried out is so much greater that one ought to hesitate before embarking on a scheme of making a separate design for every possible combination.

An arrangement that has been found to work out highly satisfactorily for such types of stations is one in which the design is split up into elements or units and each element designed, and then a certain number of combinations of these elements are worked out, but only a sufficient number to show the general assembly of the elemental units, and those only for combinations that are very common. With the elements, however, so detailed and designed, any other combination can very easily be put together, and such procedure will have practically all the advantages of the normal standard design and of a special design, but will have none of the disadvantages.

As an illustration of this Figs. 5 and 6 are shown. It will be noted that in Fig. 5 a start is made with a simple unit adequate to carry an air break switch. This is called unit No. 1. In unit No. 2 this is developed further to take care of an oil switch with a disconnect switch on either side. In unit No. 3 another variation is developed, calling for a tap-off station to feed a transformer bank, through an air break switch choke and fuse, with protective equipment in the form of a lightning arrester connected through a disconnect switch. Unit No. 4 is a variation on unit No. 3, in that the air break switch has been replaced by an oil switch. An examination of Fig. 6 shows that the synthesis has been made of some of the units shown in Fig. 5. Thus the first assembly on the top left shows two units, No. 1 combined to provide for an incoming and outgoing line, switched through air break switches, and a bus. The next assembly shows units No. 1 and No. 2 combined, which provides for the incoming line to be switched with an air break switch and the outgoing line through an oil switch. It is clear, however, that the number of combinations that could be made has not been exhausted.

Illustrative Design of Standard Substation

As illustrative of the method of applying this type of standard to a special problem Fig. 7 shows a substation planned to switch four lines and a transformer bank through a main and through an inspection bus. None of the standards shown in Figs. 5 and 6 cover this combination, but the design which was actually employed is shown in Fig. 3. (It is to be noted that Fig. 3 does not show all four feeders shown in Fig. 7, one of the four being an addition made subsequent to the development of the plan in Fig. 3.) An examination of Fig. 3 as well as Figs. 5 and 6 will show very distinctly that the source of the design in Fig. 3 is plainly the work carried out in Figs. 5 and 6. An addition had to be made to provide for the lightning arresters and two sets of disconnect switches to allow selection to the main or transfer bus, but, with the above exceptions, the design details had practically all been determined previously. Consequently, the design which is shown in Fig. 3 did not take anywhere near the time that a new design would have involved.

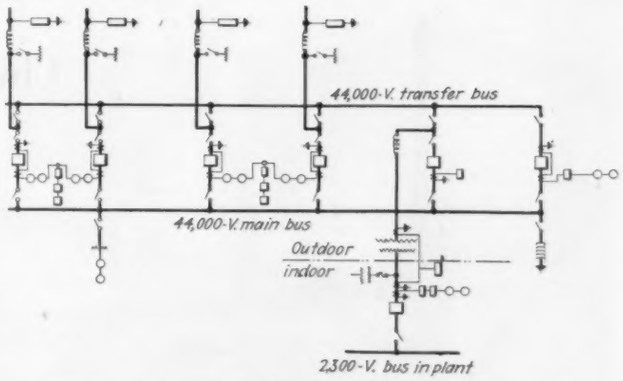


FIG. 7—ONE-LINE DIAGRAM OF PROJECTED SUBSTATION

Limits of Standardization

The question is very often asked: What limits the scope of standardization, or how far can you standardize and at what point does it become undesirable? It depends a good deal on the conditions in the organization, such as its size, the amount of work that is being handled, the type of men available to handle it and so on. The limit will, in general, be an economic one. Where there is enough work involved and where the possible benefits of standardization are comparable with the costs of carrying out such standardization, then most surely standardization can and should be worked out.

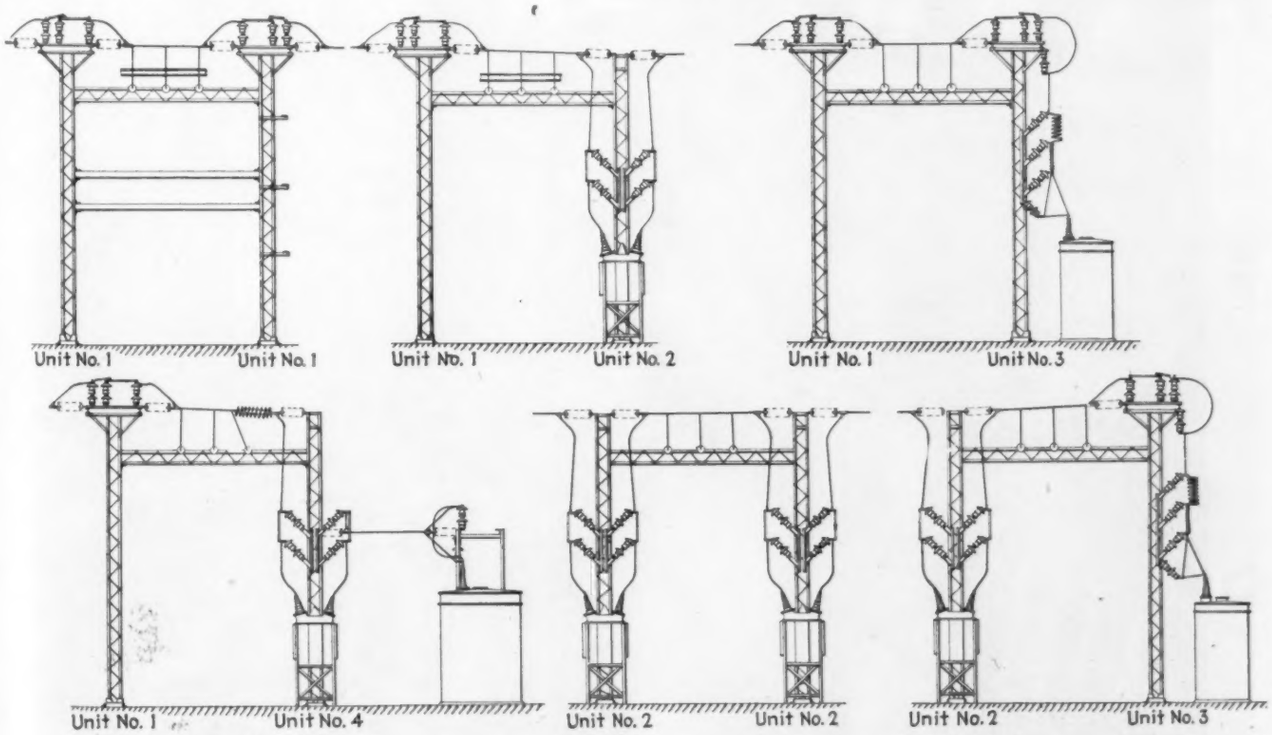
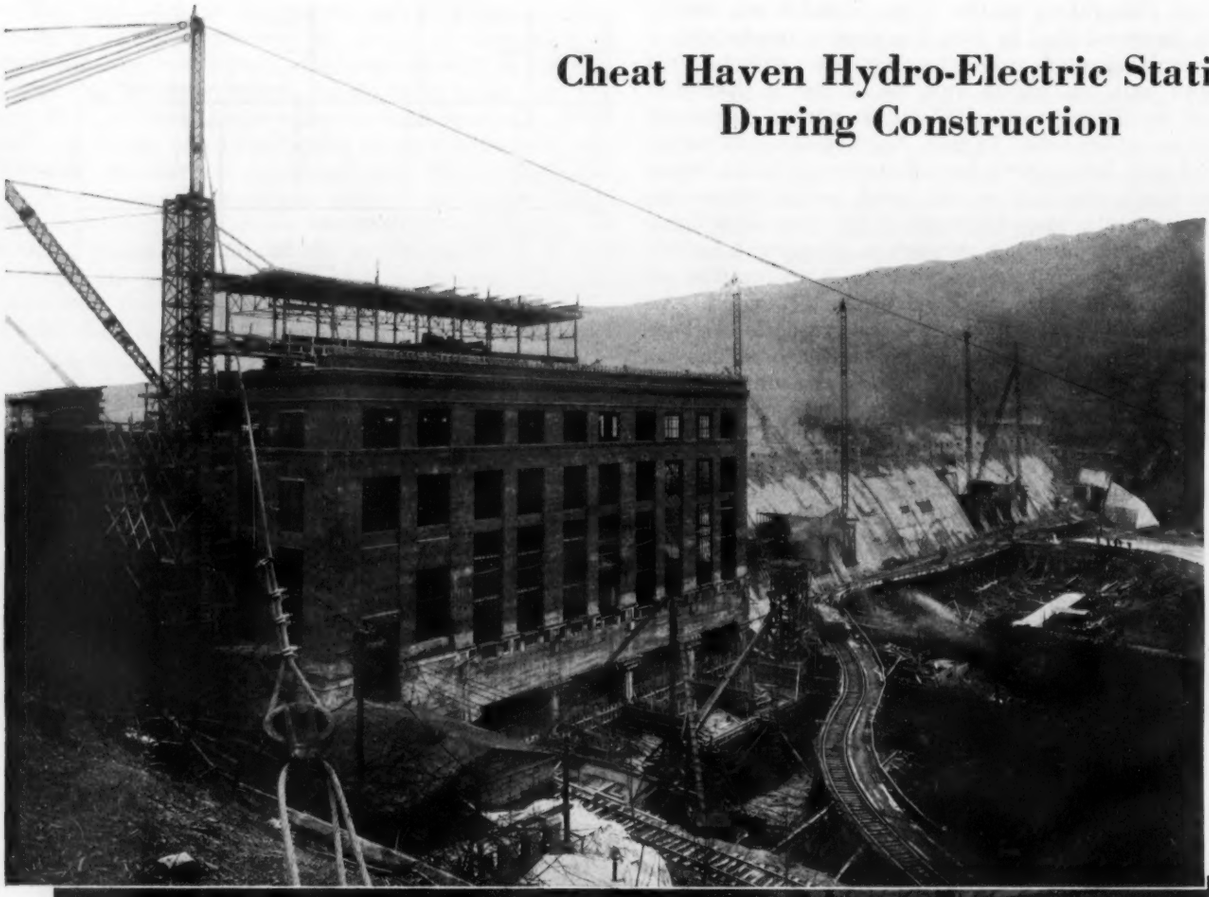
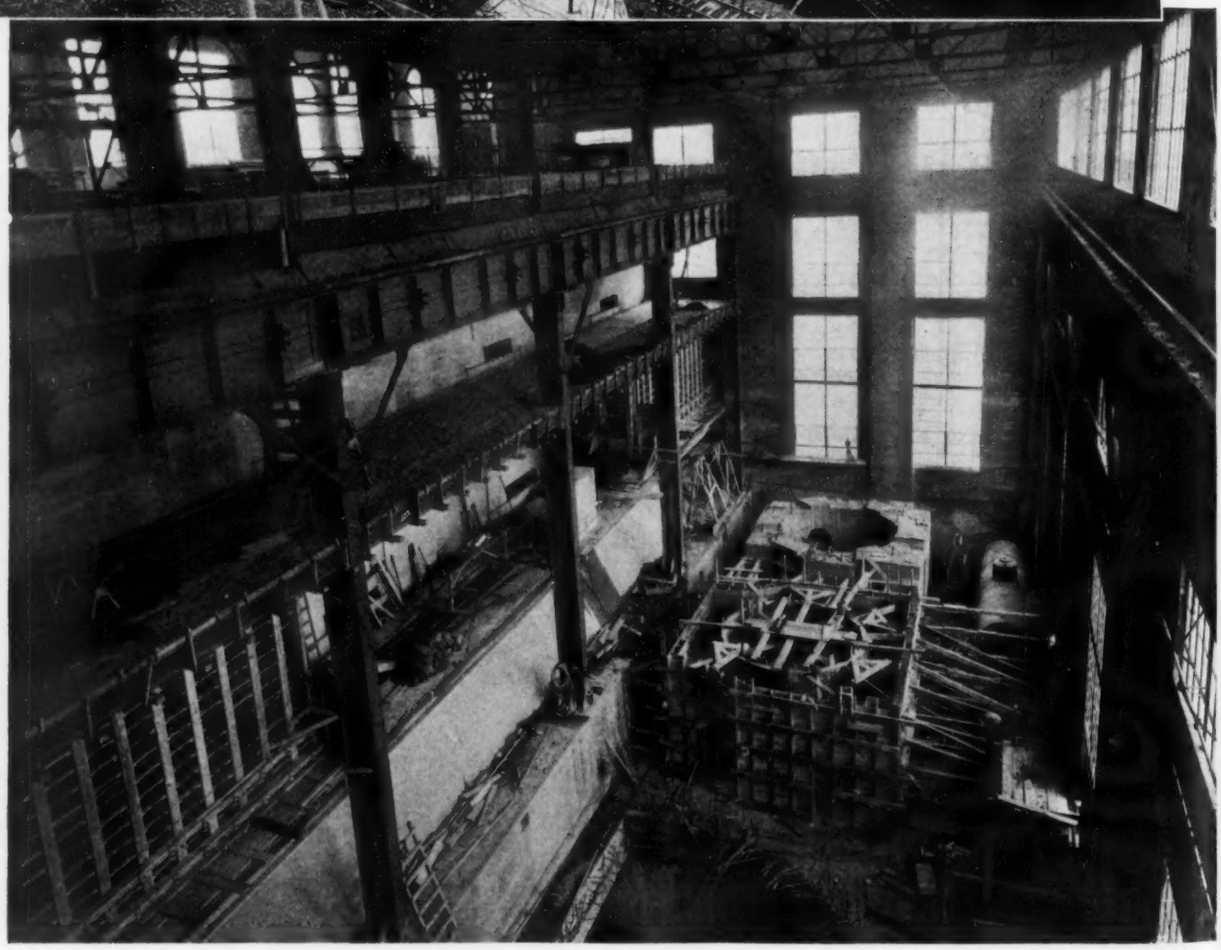
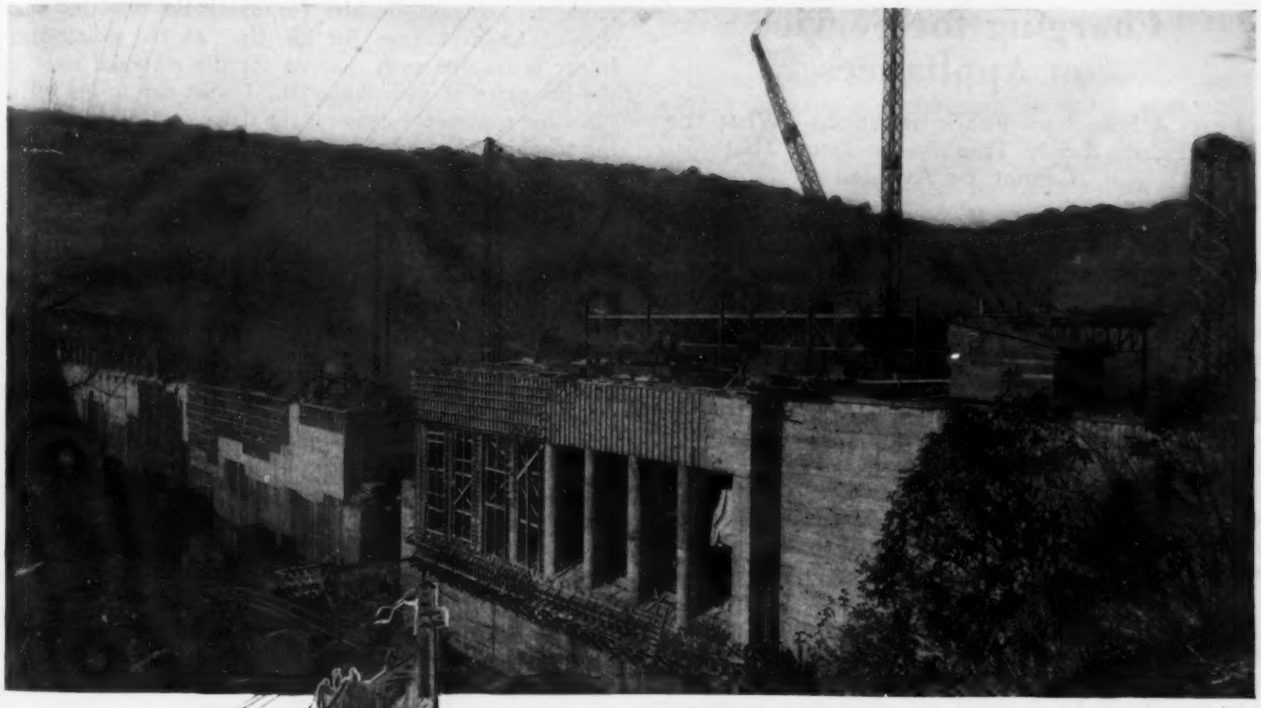


FIG. 6—ELECTRICAL ASSEMBLIES OF STANDARD 66-KV. OUTDOOR SUBSTATION UNITS. THESE ASSEMBLIES ARE MADE UP OF STANDARD UNIT DESIGNS

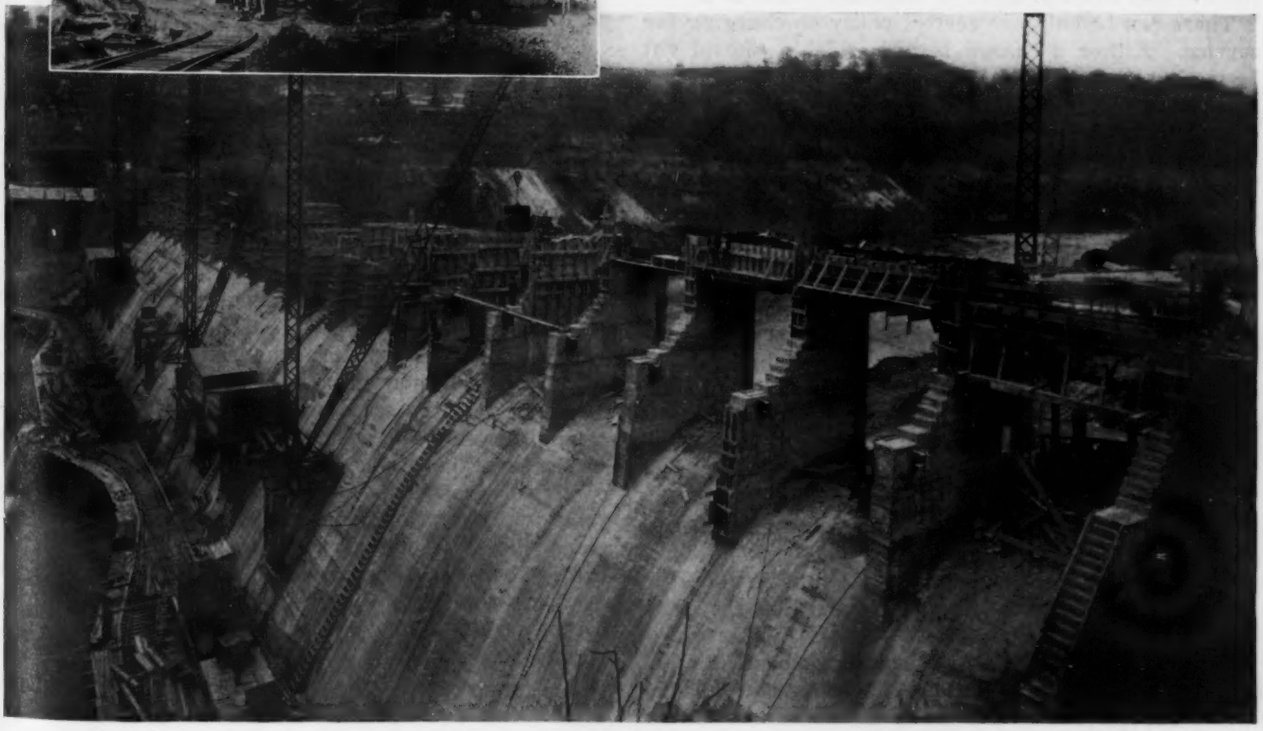
Cheat Haven Hydro-Electric Station During Construction







THE dam, which provides 31,000 acre-feet storage with a 20-ft. drawdown, is about 1,000 ft. long and 135 ft. high. The spillway is 624 ft. long and contains twenty-six 17x21-ft. Tainter gates. I. P. Morris turbines operating under an effective head of 81.5 ft. drive 16,000-kva., 11,000-volt, 60-cycle Westinghouse generators. Six 12,000-kva. water-cooled Westinghouse transformers (with a seventh unit as spare) step up the voltage to 132 kv. Sanderson & Porter designed and constructed the station.



Charging for Service on Appliances

Fear of Effect on Public Relations—What the Public Really Thinks—An Issue That Cannot Be Avoided

BY G. M. DWELLEY
Sales Manager Kelvinator Corporation, Detroit

THE question of servicing domestic appliances still remains a problem to many central-station sales managers. Should this service be given free, or should a charge be made and how much? Many and I believe the majority of central stations do not charge for service on appliances and equipment, but those that do so charge seemingly endeavor to conceal the true nature of that charge under some such guise as "monthly inspection at an annual fee of ——" instead of coming out honestly and charging for labor and material rendered at the going rate for labor and the list price for material.

Thus we have the somewhat humorous picture of an industry with one of the largest plant investments in the world serving millions of customers with what has become an absolute essential in the lives of those customers, afraid to do what an ex-lineman contractor-dealer with a total capital of $500 and no fixed investment at all does every day as a matter of course.

What is the reason for this temerity and lack of sane policy—the old bugaboo of customer relations? Have not the automobile industry, the cash register, the adding machine, the duplicating machine, the typewriting machine and all other such industries selling mechanical equipment for use by the ultimate consumer the same problem? T. F. Berger of the Philadelphia Electric Company was right when he said at the N.E.L.A. convention last year at San Francisco that if a merchandising department sold its merchandise right, installed it right, serviced it right and priced it right, there would be no problem of customer relations left.

There can be only one correct policy on charging for service. Either a charge is unjustifiable, should not be made and therefore does not enter into this discussion, or it is justifiable and should be made, and any other policy is absolutely wrong and amounts to a faint-hearted attempt at bribing the customer into thinking better of the central station. Even at that, the central station does not get results for its bribe. Let's boil this down to a concrete case for a moment as an example:

WHAT THE PUBLIC THINKS

Let us say that I have in my home a refrigerator installed by the power company; that I have an oil burner sold and installed by a plumber, and a washing machine sold and installed by a contractor-dealer. All three of them break down one day. My wife calls up all three of the agencies which sold her these appliances, requests service and gets it. When I get home at night, all three are running as usual. Does my wife then go into a detailed explanation of the fact that all three of these appliances have broken down, that she has called all three agencies responsible and that they have fixed the machines up? She does not. We go out to the movies or to a party, or some friends come in.

Two, three or four days later I receive two invoices. One from the plumber for fixing the oil burner and one from the contractor-dealer for fixing the washing machine. Each charges for his time at the going rate in my town, and each charges for the material used at the list price of such material. I then say to my wife, "Did the contractor-dealer come down and fix the washing machine?" She says "Yes" and I check the invoice for payment later. The same process is repeated with the plumber's bill. I have got the service, my wife has the use of the machine, the contractor-dealer and the plumber have their money, everybody is happy, and the transaction is closed.

But what about our timid power company? It has perhaps rendered service which cost it two, three or four times as much as that rendered either by the contractor-dealer or the plumber—and I, the man who pays the bills and whose influence and approbation it is working for, probably don't even know that it has been in the house, and all the labor, material and effort have been wasted.

FREE VERSUS CHARGE SERVICE

By all means, if the power company is going to adopt this policy of not charging for service, let it at least notify the customer as to what it is doing for him, and let it render an invoice charging for its service at the going rate for that town and for the material which is used at list price, and then if it insists upon doing it for nothing, let it stamp the invoice "Paid, with Our Compliments." In this way it will at least get credit for having done the work and having performed the service.

Yet what is my individual reaction as an American citizen to this invoice? I am not a charity patient; I am perfectly willing to pay money for value received, and under those circumstances I would probably sit down, write the company and tell it so and inclose my check for the amount. The only other reaction I might get would be a feeling of resentment at the power company and a question as to whether or not that service was worth the amount named on the invoice, inasmuch as the company did not have the nerve to charge for it. For when you get something for nothing, you value it at the price which you pay for it. Thus we have the peculiar situation of the power company doing an expensive job to get the approbation of the customer without being able to get any approbation by the customer because he does not know about it, or if it calls it to his attention, instead of getting approbation, getting the resentment felt by anyone who does not like to be a charity patient and a question as to the value of the service.

Now just what is this bugaboo of which the power company seems to be scared? The rates were determined, let us say, before the company began merchandising. It now goes into this business and gets discounts just the same as those enjoyed by the commercial dealer. The commercial dealer charges for his service and the power company does not. There are only two conclusions as to this situation. Either the rates for energy are too high (if they are sufficient to cover this free service) because they were established before there was any merchandise to service, or they do not cover this free service and show a loss which brings earnings below the point they should be. Either situation is wrong.

And so it goes. Cash registers, adding machines, duplicating machines, billing machines, your watch,

your jewelry, your suit of clothes, your golf sticks, your own body. Every time any or all of these are repaired you are charged for them and pay it cheerfully and willingly, provided the repair is done correctly.

And then having driven to work in a repaired automobile, wearing a suit of clothes on which your tailor has just sewed two new buttons, sitting in an office chair the spring of which has been repaired the day before at a service charge by the desk company that sold it to you, dictating into a dictaphone on which service was rendered the day before (at a charge) for transcription on a typewriter on which there have been three repair charges in the last month, but feeling pretty good because your osteopath (at a fee) has made repairs on a sprained back for you the night before, and chewing on a cigar with teeth that were repaired the day before yesterday by your dentist (at a fee), you dictate a letter saying that the policy of charging for service is all wrong. The power company with this sort of policy is building up a precedent that will inevitably prove a boomerang.

In every city the power company is the only agency behind all these electrical appliances which cannot go out of business and therefore in the course of time will inevitably inherit the service on all appliances. The time is going to come when the central station will have to service all appliances in a customer's home, and, when that time comes, will have to charge for service, as the expense would otherwise be too great. Right now, because this service is only partial, central stations are not charging for it and thus are building up in the customer's mind a resistance to any charge at any time by the power company for any reason.

The sensible, logical and businesslike attitude to adopt on this question is to charge the proper price for the appliance when it is sold, and thereafter to charge the going rate for expert, mechanical, electrical service, plus the list price of the material used in that service.

Engineering Versus Banker Efficiency in Hydro Development*

What Constitutes a Satisfactory Return to the Capital Investor—The Effect of Surplus Power on Capital Return—Conclusions Are Made that Surplus Power Should Be Developed to Give the Best Possible Returns to Investors

By ARNOLD PFAU
Consulting Engineer Allis-Chalmers Manufacturing Company, Milwaukee

THE returns for the capital investor accrue from the net profit of the enterprise, or from the balance after all expenses are deducted from the gross revenue. The gross revenue is obtained from the sale of electric energy—that is, from the kilowatt-hours output sold. For simplicity's sake we may disregard here reserves invested in other securities, etc. The expenses are made up of several items, such as:

1. Interests due on bonds, preferred stock, notes, or, briefly stated, on outstanding indebtedness.
2. Depreciation on the plant.
3. Operating expenses (which may include the items paid for insurance, damages, etc.).

1. *Interest on Outstanding Indebtedness.*—It is evident that the fixed gross revenue remains fairly constant, being the only source of income, once the development of the water power is accomplished with above indebtedness incurred, and thus at once it fixes the returns to the capital investor within fairly close limits. Naturally the less indebtedness that is involved the larger wiill be the returns to the capital investor. This opens a separate field for further discussion later.

2. *Depreciation.*—Since no human work lasts forever, it is necessary to base the fiscal calculation on the fact that the equipment and some of the engineering work done must at some time be fully replaced. A certain percentage of the total investment should therefore be written off from the books annually. Needless to say that the quality of the equipment and the engineering work determine what percentage must be applied for each item. This particular point is interlinked with the operation of the plant. Careless operation and maintenance is bound to increase the percentage of necessary depreciation.

3. *Operating Expenses.*—These include:

a. Salaries, wages paid.
b. Materials, such as lubricants, etc.
c. Repairs, material and wages.

As stated before, the amount of depreciation depends to a great deal on all of these three factors. It would be poor policy, for instance, to hire underpaid operators if these are incapable of properly taking care of the equipment. Proper lubricants may cost a little more but may be the cheapest in the long run, if the equipment is kept in good condition so as to bring the permanency of operation (kilowatt-hours turned out) to a maximum. Repairs should be done by skilled workers, since nothing proves more harmful to a unit than its overhaul by a so-called "monkey-wrench mechanic." (Big power systems can afford to employ a first-class master mechanic, whose duty it is to keep a watchful, skillful eye on the equipment.)

The two dominating factors affecting the return for the capital investor are:

1. The indebtedness—that is, the capital invested in the enterprise.

*Conclusion of a discussion started in the Nov. 13, 1926, issue of ELECTRICAL WORLD.

2. The gross revenue derived from the enterprise.

It goes without saying that the returns are a maximum when item 1 is a minimum and when item 2 is a maximum.

Item 2 is prefixed mainly by the amount of electric energy available from the water-power development and also to some extent by the ratio of kilowatt-hours actually turned out for revenue to kilowatt-hours available and required for the market—in other words, by the commercial efficiency of the plant, as defined before. Item 1, aside from the capital necessary for acquiring rights and titles to the water power, is prefixed by the amount of capital required for covering the expenditure of construction work to complete the development ready to sell the kilowatt-hours to the consumer. It is this item that will be made the subject of a special investigation.

The natural water-power resources of our country are limited. California and other mountainous states blessed with rivers carrying the melted snow or white coal from high altitudes are abundantly provided. Other states must be satisfied with rivers offering only medium or low heads for hydro-electric development and with a variable flow that cannot be fully stored up in seasonal reservoirs and drawn from as the market demand calls for. Hydro power producers in such states should carefully consider the possibilities offered by large interconnection of individual power systems where every available kilowatt-hour, otherwise wasted if not used, can be made to bring returns; not only from the power developed with the minimum flow of the river but also from seasonal or intermittent surplus power, which can be sold as secondary power to industries or for relieving a corresponding amount of power otherwise produced by steam or other mediums. Primary hydro power—that is, power always available from the minimum flow—should be developed for highest commercial efficiency commensurate with the market price per kilowatt-hours of the territory to be served.

Surplus hydro power—that is, power available at times of excess flow in the river, should be developed with a view of bringing best possible returns to the capital investor.

SURPLUS POWER AND CAPITAL RETURN

In order to obtain a clear conception of this problem, let us consider a water power with a minimum flow of 10,000 c.f.s. at 20 ft. available net head and an excess flow as plotted on the accompanying diagram and representing, for instance, the average of twenty years for twelve months, with corresponding flood heads reaching zero value with a flow of 30,000 c.f.s.

From the flow chart and the corresponding available net heads, Fig. 1, we can calculate the absolute kilowatts and kilowatt-hours available, as shown in the accompanying table.

In order to arrive at certain conclusions, let us make certain assumptions as to cost of development of water power. Assume that for each kilowatt absolute of the above basic power a capital investment of $150 is required. The total amount is then 17,000 × 150 = $2,550,000. Assume now that this power can be sold and the plant so managed that the investors of capital secure an annual return of 10 per cent, or $255,000 (which figures 255,000 ÷ 149,000,000, or 0.171 cent per absolute kilowatt-hour).

Let us assume now that by installing additional 11,835 kw. equipment for the surplus power and that this could be done at $100 per kilowatt absolute, or $50 cheaper than the basic power equipment which must naturally carry some of the construction work of the development. Thus an additional capital of 11,835 × 100 = $1,183,500 is required. Assume further that this surplus energy can be sold to an interconnected system at a profit base power price of 0.171 cent per kilowatt-hour absolute; we derive a surplus return to the investors of 0.171 × 39,669,000 ÷ 100 = $68,000. The returns to the surplus capital investor are 68,000 × 100 ÷ 1,183,000 = 5.73 per cent instead of 10 per cent in case of basic power capital investment. If both investments are carried under one account, the returns would be (255,000 + 68,000) ÷ (2,550,000 + 1,183,500) × 100 = 8.66 per cent.

Let us assume that the above equipment delivers 80 kw. to the receiving terminal of the power consumer

Basic Power

Minimum flow 10,000 c.f.s., net head 20 ft. (Rectangle *ABCD*) .....17,000 kw. absolute
Available twelve months, or 17,000 × 8,760.... .....149,000,000 kw.-hr.

Surplus Power

a. (Areas *BCELFGH*) 2,000 c.f.s., net head 19 ft. ..... 3,200 kw. absolute
Available about ten months.....23,300,000 kw.-hr.

b. (Areas *GHIK* and *ELMN*) 2,000 c.f.s., net head 17 ft. .....2,880 kw. absolute
Available about eight months.....14,800,000 kw.-hr.

c. (Areas *LOPQ* and *QESK* and *MNTU*) 2,000 c.f.s., net head 15 ft. .....2,540 kw. absolute
Available about five and one-half months.920,000 kw.-hr.

d. (Areas *OPVW* and *RSXY* and *UTZA'*) 2,000 c.f.s., net head 10 ft. .....1,690 kw. absolute
Available about three months.....370,000 kw.-hr.

e. (Areas *YWB'C'* and *XYD'E'* and *A'F'G'H'* and *H'I'K'Z'*) 2,000 c.f.s., net head 9 ft..1,525 kw. absolute
Available for two and one-half months..279,000 kw.-hr.

Basic power equipment..... .....17,000 kw. absolute with 149,000,000 kw.-hr.

Surplus power equipment..... .....11,835 kw. absolute with 39,669,000 kw.-hr.

Total full development..... .....28,835 kw. absolute with 188,669,000 kw.-hr.

The surplus power equipment is 11,835 or 69.4 per cent of the basic.

The surplus kilowatt-hours developed is 39,669,000 or 26.6 per cent of the basic.

for every 100 kw. absolute power available as used in our calculation. Let us now assume that the surplus power is developed somewhat differently from that of the basic power, so that only 50 kw. is delivered of the available power instead of 80 kw. as before. Let us now assume that by thus sacrificing 30 per cent in profit revenue from surplus power we can develop this power at $40 per kilowatt absolute instead of $100 as previously calculated—in other words, with a capital of 11,835 × 40 = $473,400 instead of $1,183,500. Thus a net return of (0.171 × 39,669,000 × 50) ÷ (100 × 80) = $42,500 is available for the surplus investors, or 42,500 ÷ 473,400 × 100 = 9 per cent as against 5.73 per cent in case where high-efficiency development of surplus power was carried out. Carrying both investments together into one account we have: 100 × (255,000 + 42,500) ÷ (2,550,000 + 473,400) = 9.85 per cent, as against 8.66 per cent.

It goes without saying that the moderate-efficiency development of the surplus power is a better banking

transaction than the high-efficiency surplus power development.

The above figures are not quite correct inasmuch as capital interest and depreciation on the smaller surplus power investment amount to less, even relatively, than on the larger surplus power investment. The figures of the per cent return will therefore be even somewhat higher than those shown. At the same time it must be also borne in mind that the simpler surplus power development requires a shorter period of construction work, so that a revenue is derived sooner even from the moderate capital invested, which again points toward a better financial balance sheet.

CONCLUSION

The above investigation seems to prove conclusively that surplus hydro power, particularly medium and low-head developments, should not be developed solely from the point of view of the idealistic engineer—that

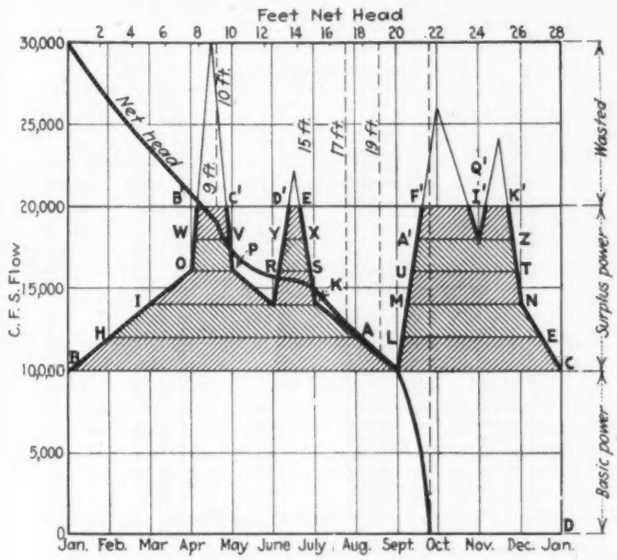


FIG. 1—DEVELOPMENT UNDER DIFFERENT CONDITIONS OF A WATER POWER WITH A MINIMUM FLOW OF 10,000 C.F.S. AT 20 FT. NET HEAD AND AN EXCESS FLOW AS INDICATED BY PLOT

is, at highest possible efficiency of the available natural resource—but entirely from a point of view of returns for the investor.

With this clearly in mind, we can gain another step in the improvement of economy of hydro development. Let us see what results we obtain if we push the completion of the installation of the surplus power equipment ahead of that of the basic equipment. Under the item of surplus power in the example cited, we have equipment for five additional groups of 2,000 c.f.s., or 10,000 c.f.s. total, which could be used under full head and continuously until the basic power equipment is in commercial operation. If the surplus power equipment were ready one year sooner than the basic equipment, as this does not consume any flow as long as it is not operating, it would bring a return to the investor of about 255,000 × 50 ÷ 80 = about $160,000. Assuming that for this purpose $100 is spent for each kilowatt absolute instead of $40, we have a capital expenditure of 17,000 × 100 = $1,700,000, as against 2,550,000, until it is ready to produce revenue—in other words, a return to the investor of 160,000 ÷ 1,700,000 × 100 = 9.43 per cent, or practically the same return as would be secured from the basic equipment when it comes in one year later—that is, with a full year's loss of returns to the investor.

The revenue of $160,000 derived in the first year is based on 10,000 c.f.s. flow at 20 ft. head and does not take in the surplus power which the equipment can develop, due to the fact that same is designed to discharge each 2,000 c.f.s. at net heads below 20 ft. and as low as 9 feet.

These figures would be materially increased, as may be realized from Case c, used in the illustrative example. This unit would discharge $2000\sqrt{20} \div 15$, or 2,310 c.f.s. and would thus develop at 20 ft. net head 3,900 kw. absolute, or 3,900 × 8,760 = 34,100,000 kw.-hr. instead of 920,000 kw.-hr. operating as surplus flow unit only. As a matter of fact all of these five surplus units could discharge a total of about 12,000 c.f.s. at 20 ft. net head—that is, about the surplus flow of 2,000 c.f.s. during ten months, thereby delivering about 20,000,000 additional kw.-hr. absolute with a revenue of $34,000, or 194,000 ÷ 1,700,000 × 100 = 11.4 per cent return to the investor. This proves again that even for primary power development the banker's viewpoint may differ from that of the engineer. The banker derives even a 1.4 per cent better return from this investment and at the same time he engages a capital that is $850,000 smaller than that required by the idealistic engineer.

These new viewpoints open for the practical hydro-electrical engineer a wide field of activity in which he again can prove his value as an indispensable co-worker of the banker—that is, of the financial interest of a hydro-electric enterprise.

Scope of the Central Laboratory of the Ecole Supérieure d'Electricité

FROM the recently issued report of the Central Laboratory of the Ecole Supérieure d'Electricité in Paris it is learned that among the new apparatus installed in the laboratory during 1925 were potentiometer reduction boxes, standard ohm and one-tenth-ohm resistances and two extremely accurate, subdivided resistances intended for the new photometric department. For the alternating-current testing and standardizing section an Abraham-Villars electric meter for 100,000 volts and a multistage transformer were acquired. During the year, at the instance of the French Ministry of Marine, a plant was installed for the testing of electric accumulators for use on submarines under the conditions of oscillation and vibration met with in actual practice. A room has also been set apart for testing the useful life of incandescent lamps. As the result of a grant from the Ministry of Public Works an order has been placed for a 300,000-volt transformer.

During the year 1,535 tests were carried out in the testing section of the laboratory, as compared with 1,388 in 1924. The tests extended to electric lamps, plates and sheets, high-tension apparatus, voltmeters, dry batteries, transformers, ammeters, wattmeters, the resistivity of conductors and insulators, accumulators, oscillographs, lightning arresters, and so forth.

Special attention is drawn in the report to the work carried out in connection with the determination of the dielectric strength of various oils and insulating materials.

Design of Tubular Copper Buses

Selection of Proper Sizes of Copper Tubing to Meet Any Given Set of Conditions with Reference to Mechanical Loading Aided by Use of Suitable Tables

By V. R. BACON

THE accompanying tables have proved to be of material assistance in the calculation of the proper sizes of copper tubing to meet any given set of conditions with reference to mechanical loading. The derivation of these tables is purely the adaptation of the simple beam formulas, the calculation of conversion constants and the segregation and rearrangement of many data that have appeared elsewhere in published form but which have been more or less fragmentary in nature. Wherever possible, the slide rule has been used in the preparation of the tables, and therefore greater than slide rule accuracy should not be expected.

Although the tables have been calculated and the examples given for copper tube, they may be used with equal facility for buses or beams of any shape and of other material by applying the proper adaptation factors for the particular shape or material under consideration. Since the work has been extended to cover outdoor conditions, the addition of the ice and wind load has made the solution by aid of the tables a matter of trial when the span length is fixed, as is the usual case. This cannot be avoided, as there is no continuous mathematical relation among the various commercial sizes of tubing and the dead loads to which they may be subjected under the various weather conditions that may be assumed.

EXPLANATION OF TABLES AND EXAMPLES

Two sets of factors, which have been called the I/c and the dI factors, are given in Table I. The I/c factors give the required section modulus for a simple beam, freely supported at both ends, such that the maximum fiber stress will not exceed 10,000 lb. per square inch (the average elastic limit of soft-tempered or annealed copper) when the beam is loaded uniformly with 1 lb. per foot. In order to extend the utility of the table, it is necessary to multiply the tabular factors by the following adaptation factors:

1. For any working stress other than 10,000 lb. per square inch, multiply by the ratio of 10,000 to the desired working stress in pounds per square inch.
2. For any particular loading, multiply by the particular loading stated in pounds per foot.
3. For a fixed beam, multiply by 0.666.
4. For the safety factor, multiply by the safety factor desired.

The dI factors give the product of the deflection in inches and the moment of inertia for a simple beam of a material the modulus of elasticity of which is 10,000,000, freely supported at both ends, when uniformly loaded with 1 lb. per foot. Here again it is necessary to apply a number of adaptation factors to broaden the use of the tables:

1. For moduli of elasticity other than 10,000,000, multiply by the ratio of 10,000,000 to the applicable modulus.
2. For any particular loading, multiply by that loading in pounds per foot.
3. For a fixed beam, multiply by 0.20.
4. For the safety factor, multiply by the safety factor desired.

The weight, loadings, section moduli, moments of inertia and areas for standard I.P.S. copper tubing are given in Table II. Table III is the same as Table II except that it applies to extra heavy I.P.S. copper tubing. Table IV gives the section moduli, the moments of inertia and the areas of a limited range of flat copper bar to which the tables apply equally well.

The explanation of the use of the tables assumes that the buses are calculated for two loads—the dead load (weight of material, wind and ice) and the magnetic load. Assume that the magnetic load, the span, section shape of the conductor, the material of the conductor, the worst weather conditions to which the bus will be subjected and safety factor are known and that the proper size of conductor to meet the known conditions is required.

TABLE I—BEAM COEFFICIENTS FOR COPPER TUBING

Span Ft.	I/c In.^{3}	dI In.^{5}	Span, Ft.	I/c In.^{3}	dI In.^{5}
1	0.00015	0.0000023	26	0.1015	1.030
2	0.00060	0.0000360	27	0.1093	1.197
3	0.00135	0.0001821	28	0.1177	1.382
4	0.00240	0.0005765	29	0.1262	1.595
5	0.00375	0.0014080	30	0.1350	1.822
6	0.00540	0.0029200	31	0.1442	2.075
7	0.00735	0.0054150	32	0.1535	2.360
8	0.00960	0.0092200	33	0.1632	2.660
9	0.01215	0.0147600	34	0.1732	3.008
10	0.01500	0.0225000	35	0.1837	3.374
11	0.01815	0.0329200	36	0.1942	3.780
12	0.02160	0.0466500	37	0.2053	4.220
13	0.02535	0.0642000	38	0.2163	4.680
14	0.02940	0.0865000	39	0.2282	5.215
15	0.03375	0.1140000	40	0.2400	5.765
16	0.03840	0.1474000	41	0.2520	6.370
17	0.04335	0.1882000	42	0.2648	7.030
18	0.04860	0.2361000	43	0.2772	7.675
19	0.05420	0.2924000	44	0.2905	8.420
20	0.06000	0.3600000	45	0.3035	9.230
21	0.06620	0.4375000	46	0.3172	10.060
22	0.07260	0.5275000	47	0.3310	11.000
23	0.07930	0.6296000	48	0.3460	11.980
24	0.08640	0.7460000	49	0.3600	13.100
25	0.09375	0.8780000	50	0.3750	14.070

Neglect the safety factor and the dead load at first. Get the I/c factor for the given span from Table I. Multiply that factor by all applicable adaptation factors. Then divide the product so obtained successively into the section moduli for the desired class of conductor as given in Tables II, III and IV, until a quotient is obtained which is somewhat greater than the contemplated safety factor. The size corresponding to the section modulus that gives the quotient somewhat greater than the safety factor is called the trial size and will be close to the proper size, provided the ratio of the dead load to the magnetic load is small. The size, however, should be checked as follows:

Take the I/c factor for the given span from Table I and again multiply it by all of the applicable adaptation factors as before, but in this case include with the magnetic load the dead load for the size as determined by the previous trial. Divide this product into the section modulus for the size chosen above. If the quotient is equal to or greater than the safety factor, the size so determined will fulfill the conditions. When the ratio of the dead load to the magnetic load is large, several trials may be necessary before the suitable size can be found.

The use of the tables as outlined above may be illustrated by the following example: Given an 8-ft. fixed span, hard-tempered copper tube, dead load of 8-lb. wind and ½-in. ice, magnetic load of 15 lb. per foot and a safety factor of 2 based on the elastic limit. Required to find the commercial size of tube.

From Table I, I/c for an 8-ft. span is 0.0096. The adaptation factors are: Working stress factor (10,000/22,000) = 0.4545. Beam class factor (for fixed beam) = 0.666. Partial loading factor (magnetic) = 15.000.

The adapted trial I/c factor is:

$$0.0096 \times 0.4545 \times 0.666 \times 15 = 0.0426.$$

TABLE II—COPPER TUBE DATA AND LOADINGS—STANDARD I.P.S.

Size, In.	Outside Diameter, In.	Vertical Loading, Lb. per Ft. Tube Only	Vertical Loading, Lb. per Ft. Tube and ½-In. Ice	Vertical Loading, Lb. per Ft. Tube and ¾-In. Ice	Horizontal Loading, Lb. per Ft. 15-Lb. Wind, No Ice	Horizontal Loading, Lb. per Ft. 8-Lb. Wind, ½-In. Ice	Horizontal Loading, Lb. per Ft. 11-Lb. Wind, ¾-In. Ice	Resultant Loading, Lb. per Ft. 15-Lb. Wind, No Ice	Resultant Loading, Lb. per Ft. 8-Lb. Wind, ½-In. Ice	Resultant Loading, Lb. per Ft. 11-Lb. Wind, ¾-In. Ice
¼	0.675	0.65	1.38	1.98	0.84	1.12	1.99	1.06	1.77	2.82
⅜	1.050	1.31	2.28	2.99	1.31	1.70	2.34	1.86	2.66	3.80
1	1.315	1.79	2.92	3.72	1.64	1.55	2.58	2.43	3.30	4.53
1¼	1.660	2.63	3.98	4.98	2.07	1.77	2.90	3.35	4.36	5.68
1½	1.900	3.15	4.65	5.63	2.38	1.94	3.12	3.95	5.04	6.44
2	2.375	4.20	4.99	7.13	2.97	2.25	3.57	5.14	6.40	7.97
2½	2.875	6.04	8.15	9.43	3.59	2.58	4.01	7.03	8.55	10.25
3	3.500	8.72	11.21	12.70	4.38	3.00	4.58	9.76	11.62	13.52
3½	4.000	11.45	14.26	15.90	5.00	3.34	5.04	12.50	14.64	16.70
4	4.500	13.33	16.45	18.25	5.63	3.67	5.50	14.45	16.95	19.10
4½	5.000	14.60	18.03	19.98	6.25	4.00	5.96	15.90	18.50	20.82
5	5.563	16.54	20.32	22.45	6.96	4.37	6.47	17.93	20.80	23.30

Size, In.	Section Modulus	Moment of Inertia	Area in Sq.In.	Area in Sq.Cm.
¼	0.0222	0.0075	0.1760	224,048
⅜	0.0403	0.0169	0.2474	315,000
½	0.0708	0.0372	0.3352	426,790
1	0.1280	0.0842	0.4723	601,351
1¼	0.2412	0.2005	0.6944	884,138
1½	0.3342	0.3174	0.8247	1,050,041
2	0.5664	0.6732	1.0907	1,388,723
2½	0.9976	1.4336	1.5831	2,015,666
3	1.7405	3.0456	2.2572	2,873,957
3½	2.5955	5.1909	2.9449	3,749,565
4	3.3559	7.5491	3.3380	4,250,075
4½	4.2128	10.5319	3.7307	4,750,076
5	5.2932	14.7278	4.1808	5,323,162

Refer to Table II and note that the section modulus for 1-in. standard I.P.S. tube (0.1280) divided by the trial factor (0.0426) gives a safety factor of 3.0. Therefore it would seem the 1-in. standard I.P.S. would be satisfactory. To check, note the dead load for 1-in. standard I.P.S. in Table II to be 3.3 lb. per foot. Correct the loading factor by adding the dead load to the magnetic load (15.00 + 3.3) and get the corrected total loading factor, 18.3. Recalculate the adapted trial factor,

$$0.0096 \times 0.4545 \times 0.666 \times 18.3 = 0.052$$

Divide the corrected, adapted trial factor (0.052) into the section modulus for 1-in. standard I. P. S. tubing (0.1280) and get the safety factor 2.46. Since this condition gives a safety factor (2.46) that is somewhat too large, the next size smaller should be tried, using the same I/c factor and the same adaptation factors except in the total loading, in which case the total loading for ¾-in. standard I.P.S. is used. This will give a result of 0.0503. This corrected, adapted trial factor divided into the section modulus for ¾-in. standard I.P.S. (0.0708) gives a safety factor of 1.41, which is too small. Since the two sizes 1 in and ¾ in. give safety factors other than desired, the choice becomes a matter of judgment based on local conditions. However, in this case, the 1-in. tube would undoubtedly be used.

TABLE III—COPPER TUBE DATA AND LOADINGS—EXTRA HEAVY I.P.S.

Size, In.	Outside Diameter, In.	Vertical Loading, Lb. per Ft. Tube Only	Vertical Loading, Lb. per Ft. Tube and ½-In. Ice	Vertical Loading, Lb. per Ft. Tube and ¾-In. Ice	Horizontal Loading, Lb. per Ft. 15-Lb. Wind, No Ice	Horizontal Loading, Lb. per Ft. 8-Lb. Wind, ½-In. Ice	Horizontal Loading, Lb. per Ft. 11-Lb. Wind, ¾-In. Ice	Resultant Loading, Lb. per Ft. 15-Lb. Wind, No Ice	Resultant Loading, Lb. per Ft. 8-Lb. Wind, ½-In. Ice	Resultant Loading, Lb. per Ft. 11-Lb. Wind, ¾-In. Ice
¼	0.675	0.87	1.60	2.20	0.84	1.12	1.99	1.22	2.00	2.97
⅜	0.840	1.33	2.17	2.82	1.05	1.23	2.15	1.69	2.49	3.54
½	1.050	1.75	2.72	3.43	1.31	1.37	2.34	2.18	3.05	4.15
1	1.315	2.48	3.61	4.41	1.64	1.55	2.58	3.00	3.92	5.10
1¼	1.660	3.47	4.82	5.72	2.07	1.77	2.90	4.04	5.14	6.41
1½	1.900	4.46	5.96	6.95	2.38	1.94	3.12	5.05	6.26	7.61
2	2.375	5.73	7.52	8.66	2.97	2.25	3.57	6.45	7.80	9.37
2½	2.875	8.72	10.83	12.11	3.59	2.58	4.01	9.43	11.13	12.75
3	3.500	11.76	14.26	15.74	4.38	3.00	4.58	12.54	14.56	16.40
3½	4.000	14.39	17.20	18.84	5.00	3.34	5.04	15.20	17.54	10.50
4	4.500	17.33	20.45	22.25	5.63	3.67	5.50	18.17	20.72	22.92
4½	5.000	21.10	24.53	26.48	6.25	4.00	5.96	22.00	24.92	27.12
5	5.563	23.94	27.72	29.86	6.96	4.37	6.47	24.92	28.09	30.60

Size, In.	Section Modulus	Moment of Inertia	Area in Sq.In.	Area in Sq.Cm.
¼	0.0257	0.0087	0.2191	279,678
⅜	0.0480	0.0202	0.3235	411,893
½	0.0861	0.0452	0.4405	560,862
1	0.1619	0.1064	0.6478	824,805
1¼	0.2940	0.2438	0.8934	1,137,513
1½	0.4152	0.3945	1.0823	1,378,028
2	0.7370	0.8749	1.4955	1,904,130
2½	1.3464	1.9404	2.2827	2,906,425
3	2.2432	3.9255	3.0523	3,886,310
3½	3.1568	6.3136	3.7098	4,723,338
4	4.3026	9.6809	4.4551	5,672,412
4½	5.9100	14.7500	5.4450	6,931,485
5	7.4186	20.6339	6.1130	7,783,316

Due to clearance limitations, it is often desirable to know what the deflection or sag of the bus may be under any given set of conditions and for a size chosen.

This is accomplished by the use of the dI factors given in Table I. To make use of these factors it is necessary to know or assume the following: The temper of the material (for the modulus of elasticity), the size and shape of the material (for the moment of inertia), the total loading, the span length and the class of beam. Knowing or assuming the above, get the dI factor corresponding to the given span, multiply this factor by all of the applicable adaptation factors to get the adapted dI factor. Then divide the adapted dI factor by the moment of inertia of the bus under investigation and the quotient will be the deflection in inches. For example, to get the deflection in the 1-in. tube considered above. The adaptation factors are as follows: Modulus of elesticity factor, 10,000,000 ÷ 16,000,000 = 0.625. Beam class factor (fixed) = 0.2. Total loading factor = 18.3. Moment of inertia for 1-in. standard I.P.S. = 0.0842.

From the table, the dI factor for an 8-ft. span is 0.00922. The adapted dI factor is then:

$$0.0092 \times 0.625 \times 0.2 \times 18.3 = 0.0211.$$

The sag or deflection in inches is then:

$$0.0211 \div 0.0842 = 0.25 \text{ in.}$$

It will be noted in the above that reference to the safety factor has been omitted. In general, the deflection is merely a check calculation and it is desired to know the worst condition, hence the use of a safety factor is only confusing. In this case a safety factor of 2 would have made the deflection appear twice as great as it was likely to be.

TABLE IV—FLAT COPPER BAR DATA

Size, In.	Weight Lb. per Ft.	Area Sq.In.	Area Sq.Cm.	Edgewise I/c In.³	Edgewise I In.⁴	Flat I/c In.³	Flat I In.⁴
¼ x 1	0.482	0.125	159,154	0.02083	0.01041	0.002604	0.0001627
2	0.964	0.250	318,309	0.08332	0.08332	0.005208	0.0003254
3	1.446	0.375	477,463	0.18750	0.28125	0.007812	0.0004881
4	1.928	0.500	636,618	0.33328	0.66656	0.010416	0.0006508
5	2.410	0.625	795,772	0.52075	1.30188	0.013020	0.0008145
6	2.892	0.750	954,927	0.75000	2.25000	0.015624	0.0009762
½ x 1	0.964	0.250	318,309	0.04166	0.02083	0.104166	0.0013020
2	1.928	0.500	636,618	0.16664	0.16664	0.208332	0.0026040
3	2.892	0.750	954,927	0.37500	0.56250	0.312498	0.0039060
4	3.856	1.000	1,273,236	0.66666	1.33332	0.416664	0.0052080
5	4.820	1.250	1,591,545	1.04150	2.60375	0.520830	0.0065100
6	5.784	1.500	1,909,854	1.50000	4.50000	0.624996	0.0078120
¾ x 1	1.450	0.375	477,463	0.06250	0.03125	0.023437	0.0043945
2	2.900	0.750	954,927	0.25000	0.25000	0.046874	0.0087880
3	4.350	1.125	1,432,390	0.56250	0.84375	0.070311	0.0131835
4	5.800	1.500	1,909,854	1.00000	2.00000	0.093748	0.0175780
5	7.250	1.875	2,387,317	1.56250	4.90625	0.117185	0.0219725
6	8.700	2.250	2,864,781	2.25000	6.75000	0.140622	0.0263570

The tables may be used for the reverse operation. That is, to find the span when other factors are known. This operation will give nearly correct results by interpolation, but is seldom used, since the span is generally fixed by structural considerations.

An example of this operation is as follows: Given a 1-in. standard I.P.S. tube of annealed copper, magnetic load of 0.25 lb. per foot, dead load (15 lb. wind, no ice) of 2.43 lb. per foot, total load of 2.68 lb. per foot, safety factor of 2 and a simple beam. Required to find the length of span. The adaptation factors are: Working stress factor, 10,000 ÷ 10,000 = 1. Beam class factor, simple = 1. Safety factor = 2. Loading factor = 2.68.

From Table II, the section modulus for 1-in. standard I.P.S. is 0.128. The adapted I/c factor is:

$$0.128 \div (1 \times 1 \times 2 \times 2.68) = 0.0239.$$

Referring to Table I, it is seen that the I/c factor for a 12-ft. span is 0.0216 and for a 13-ft. span is 0.02535. Then, by interpolation, the permissible span is 12.62 ft.

An example of the reverse operation in the use of the dI factors is as follows: Given a ¾-in. standard I.P.S. tube of hard-tempered copper, no magnetic load, dead load of ¾-in. ice with no wind load, fixed beam, maximum sag of 4 in. and a safety factor of 2. Required to find the maximum span. The adaptation factors are: Modulus of elasticity factor, 10,000,000 ÷ 15,000,000 = 0.667. Loading factor, ¾-in. ice, no wind = 2.99. Beam class factor, fixed beam = 0.2. Safety factor = 2.

From Table II, the moment of inertia of ¾-in. standard I.P.S. tube is 0.0372. Then, the adapted dI factor is:

$$(4 \times 0.0372) \div (0.2 \times 0.667 \times 2 \times 2.99) = 0.1865.$$

From Table I, the *dI* factor for a 16-ft. span is 0.1474 and for a 17-ft. span 0.1882. Hence, by interpolation, the maximum span is 16.96 ft.

Unless already ascertained, a calculation such as the above should be checked back through the *I/c* factors to be sure that the span determined is not excessive for the flectural strength of the section and material.

No attempt has been made to consider the buses as continuous beams. In many instances where insulator clamps are short or in cases where buses are supported on suspension insulators it might seem more accurate as well as economical to consider such buses as continuous beams. As a rule such applications are rather infrequent and, unless large quantities of copper are used, the saving affected by calculating as continuous beams will scarcely warrant the additional work. Further, computations assuming the buses to be fixed beams (where such assumption is justifiable and where the bus is continuous) introduces an inherent safety factor which, to some degree, may offset minor imperfections in material.

In general, care should be taken to secure the physical properties of the bus material from the manufacturer. When such data are unobtainable, the following may be used as a guide when dealing with copper:

	Temper	Elastic Limit, Lb. per Sq.In.	Tensile Strength, Lb. per Sq.In.
High-conductivity tubing:	Hard.....	22,000	45,000
	Annealed..	10,000	32,000
Deoxidized copper tubing:	Hard.....	22,000	45,000
	Annealed..	10,000	32,000
High-conductivity bars:	Hard.....	18,000	36,000
	Annealed..	10,000	30,000

The modulus of elasticity for copper of different tempers is apparently not very well defined and varies with the temper and somewhat with the shape of the material, but ranges from 10,000,000 to 18,000,000, increasing with the hardness of the temper. In general, 12,000,000 and 16,000,000 may be taken as the modulus of elasticity of annealed and hard-drawn copper respectively.

Letters from Our Readers

Justice of Simple Residence Rates Questioned

To the Editor of the ELECTRICAL WORLD:

I do not understand how you can reconcile the divergent editorials contained in your issue of Oct. 9.

On page 739 the editorial entitled "Business Principles in Commercial Developments" praises the articles by Colonel C. F. Lacombe. His articles extol the advantages of careful analyses and discriminating rate structures. All persons who have given careful study to the subject of electric rates appreciate that in order to have equity it is necessary to introduce complexities. It was at first attempted to achieve simplicity in the internal revenue act, but in order to equalize the burden between the taxpayers in proportion to their ability to pay it was found necessary to introduce considerable complexities. So it is with electric rates. If we are to have inducing rates for those classes of business which are least able or willing to pay, but rates which will collect an adequate amount of total revenue, we must depart from the simplicity which would otherwise be desirable and have forms which are somewhat complex.

It is therefore with extreme regret that I note the second and contradictory editorial on page 741, entitled "The Trend in Residence Rates." In the first place, there is no such trend as you suggest. Actually the trend is in exactly the reverse direction. Nearly all companies with which I am familiar are introducing area, outlet or three-part rates. There is more excuse for a simple rate in the gas business than there is in the electric business, as the element of load factor is of less importance. Gas can be stored. But Henry L. Doherty has recently secured the approval of the West Virginia commission to a three-part gas rate. He has probably given more study to the gas business and to what is the matter with it than any other man living. Most of us in the electrical business think the gas business is suffering from dry rot, but very few have taken the trouble to find out. Judging by the great progress of gas companies under the Doherty management, he has found the cause of the trouble. He says it is in the form of rate, that it is all wrong to sell gas by the thousand cubic feet, and that an inducing form of rate should be used, exactly as is recommended by Colonel Lacombe as to electric rates. It is regrettable, therefore, that you advise that forward-looking companies should change their types of electric rates so as to sell electricity by the yard or bushel, which is the effect of suggesting a block rate with such slight variations as 7 cents, 5 cents and 3 cents.

The writer of this editorial discloses his ignorance of the subject by the statement that 30 kw.-hr. at 10 cents and 100 kw.-hr. at 4 cents will produce approximately the same result as similar quantities at 7 cents and 5 cents. The discussion is about residence rates, and for residence business the second set of figures will produce 25 per cent less revenue than the first set.

Contrary to the implication in the latter part of the editorial, managers who have analyzed their experience and really studied the subject know that the size of the rate has little, if any, effect upon the use of electricity for lighting or for commonly used appliances. They know that the way to encourage additional use, on a basis helpful to both the consumer and the company, is to devise a rate which will collect all fixed charges and applicable operating expenses from the energy furnished for lighting and incidental uses, with a very low follow-on rate for energy used for cooking, refrigeration and similar applications which people cannot, or will not, afford except at low rates, and which energy can be furnished at low rates after the other business has first carried the principal burden of costs. These results can be accomplished by rates which are not very complex, but they cannot be accomplished by rates of the form commended in this editorial.

You will recollect that some time ago you argued that public utility companies should allow their rates to be fixed on the basis of prudent investment (original cost). There was a good deal of controversy in your columns on this subject. The writer was among the few who from the beginning took the position that present value (reproduction cost less depreciation) is the proper basis. Now hardly any one connected with the industry can be found who will admit that he ever believed in, or argued for, anything else. Justice and simplicity do not go together in our present complex civilization. While it is unquestionably desirable that rate structures should be as simple as possible, the three important things to bear in mind are:

1. Not to serve any branch or class of business below cost.

2. To make rates inducing to the business which must be induced.

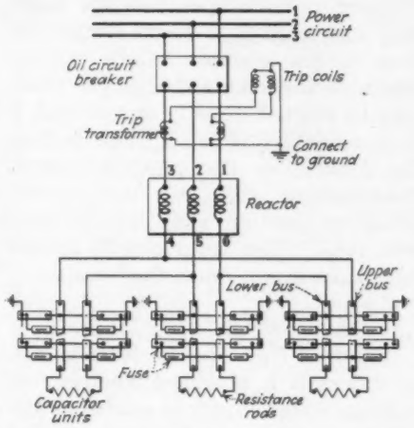
3. That the greater burden of cost must be carried by those portions of the business which are most able to pay.

H. C. HOPSON.
Associated Gas & Electric Company,
New York.

Central Station and Industrial Practice

Power-Factor Correction in a Railroad Shop

A 120-kva., 2,300-volt capacitor was purchased in the summer of 1925 by the Rutland Railroad Company to correct the power factor in its Rutland (Vt.) repair shops. Through the courtesy of L. G. Morphy, chief engineer, the results of this installation are given herewith. Energy is supplied to the shops, railroad station and offices of the company by the Vermont Hydro-Electric Corporation. Prior to the installation of the capacitor the power factor was about 60 per cent, and the railroad paid a penalty of 4 mills per kilowatt-hour. The energy consumption is about 35,000 kw.-hr. per month, 5,000 of this being for lighting service. The power factor is now between 96 and 98 per cent and the company receives a rebate of 1 mill per kilowatt-hour. The cost of the capacitor was about $2,800 installed, and Mr. Morphy states that the fixed charges total about $606 per year and that the equipment saved the railroad company $1,033 in power bills in six months. Several relocations of motors aided in the work.



CONNECTIONS OF ONE HALF OF 120-KVA., 2,300-VOLT CAPACITOR AT RUTLAND, VT.

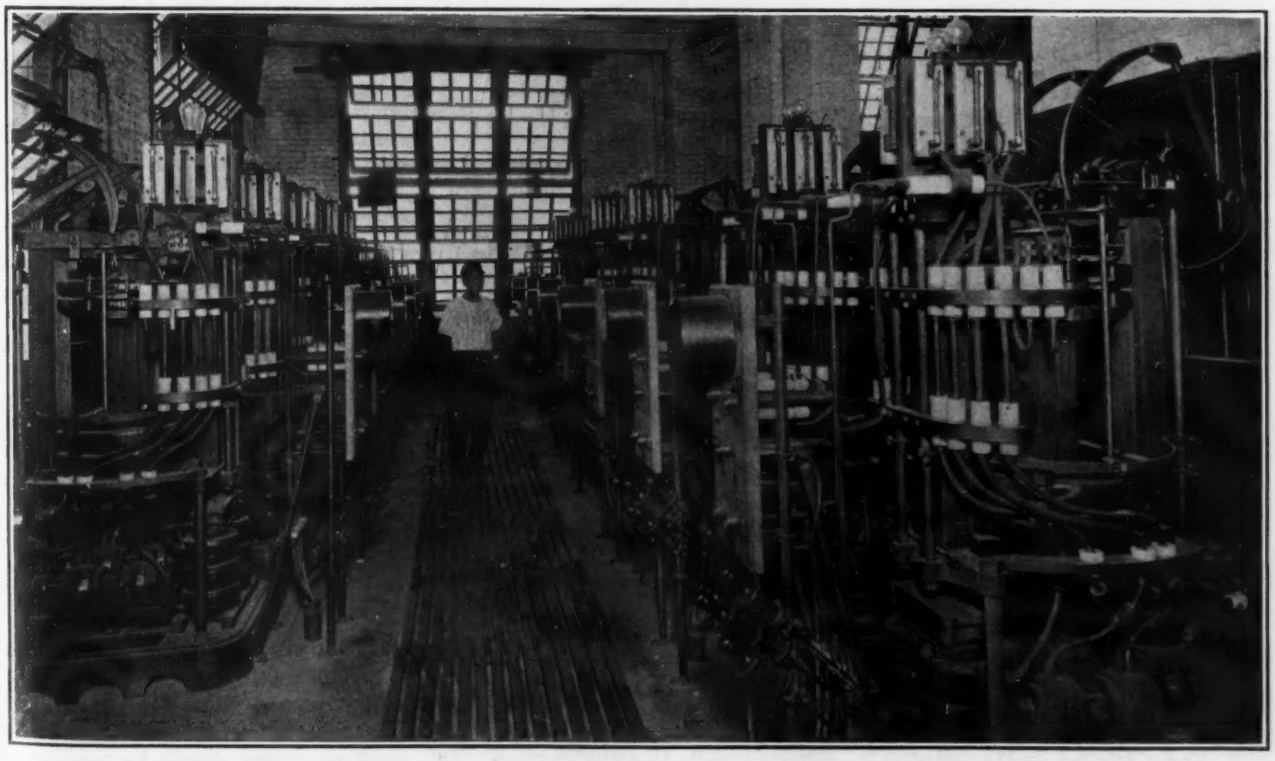
The equipment, which was built by the General Electric Company, was designed to correct a load of 133 kw. from 45 to 80 per cent power factor. It is divided into two 60-kva. sections. Each section is provided with its own oil circuit breaker, reactor and fuses, the latter serving to clear any defective section. The reactors serve to dampen out oscillations when the condenser is connected, and prevent the absorption of high-frequency current by the condenser section. In the daytime both sections of the capacitor are operated, but at night, to save losses, the two units are used alternately.

Upkeep and Operation of Mercury-Vapor Rectifiers

BY J. R. DOWDELL
Chief Electrician Houston Lighting & Power Company, Houston, Tex.

OPERATORS of the Houston Lighting & Power Company are guided by the following policies in examining, installing, drying out and operating mercury-vapor rectifiers:

Examination.—Sufficient vacuum in the tubes is ascertained roughly by the sharp click heard when the mercury is moved about in the tube and by observation whether the mercury entirely fills the cathode and starting anode chambers. If there is little or no vacuum, bubbles will appear in the mercury in these chambers. Before placing a tube in service care is taken to see that all leads are in good order and that



ARC-LIGHT RECTIFIER SETS OF HOUSTON LIGHTING & POWER COMPANY

when the tubes are turned right side up no mercury is left around the anodes or seals. (Two new tubes are always kept in reserve for each tube operating.)

Installation.—When installing the tubes, precautions are taken to see that the three flexible leads and connections to the starting anode and cathode are arranged so they will not come in contact with one another. The flexible leads to the main anode are arched into an inverted "U" so that when the tube is moved there can be no strain on the glass where the lead leaves the tube. Separation of the flexible anode leads from the glass is also assured in order to prevent danger of puncturing the tube when it is started up cold or started directly on the arc circuit. If the tubes will not operate on the load, they are cleaned or static protectors are applied. Two protectors are used on a tube—one over each anode. The glass bushings are never omitted.

Drying.—In drying out the tubes on direct-current short circuit, the current for a 4-amp. set is maintained between 5.5 and 7 amp. for at least one hour, after which an attempt is made to "pick up" the arc circuit. A short circuit is maintained for this period to be sure there is no mercury left in the vicinity of the anode that might cause puncture. If the dried out tube should be accidentally turned upside down it is dried out again. During regular operation the tubes are subjected to a short circuit for five to ten minutes before putting them on the load, although the tubes can be started directly on the load if it is necessary to do so. This is done by separating the constant-current transformer coils to the normal running position and then shaking the tube. The lamp circuit should pick up without much fluctuation.

OPERATION

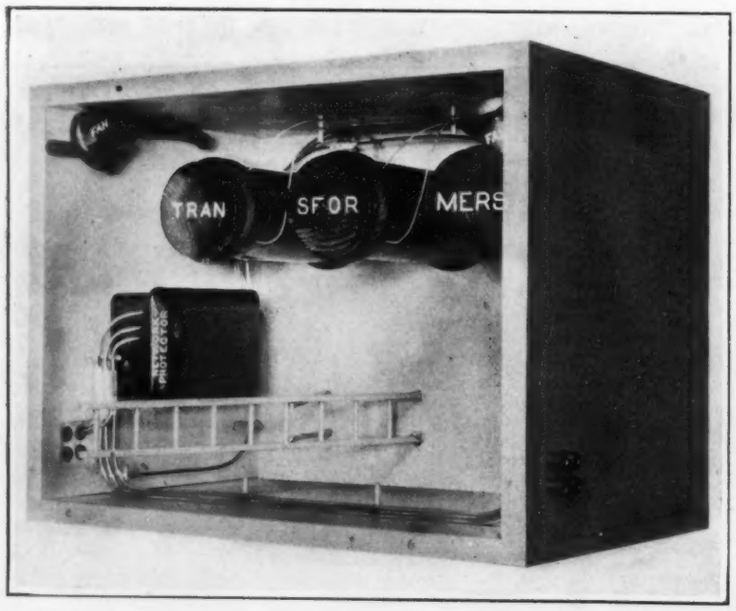
Starting Up.—Before starting the rectifiers it is observed whether the cooling water supply is available, the oil temperature is between 60 and 90 deg. and the transformer coil is latched up. Then, if inserting the primary and short-circuit plugs and shaking the tubes start operation and the pilot lamp lights, it is observed whether the transformer coil has unlatched. If it has, the arc line plugs are inserted and after running five minutes on short circuit the short is removed and the movable transformer coil assisted to the normal running position. The oil temperature is maintained as uniform as possible—usually between 75 and 85 deg. F.

Shutting Down.—This operation is performed in the following order: Pulling the primary and arc-line plugs, pulling up and fastening the transformer coil and cutting off the water supply.

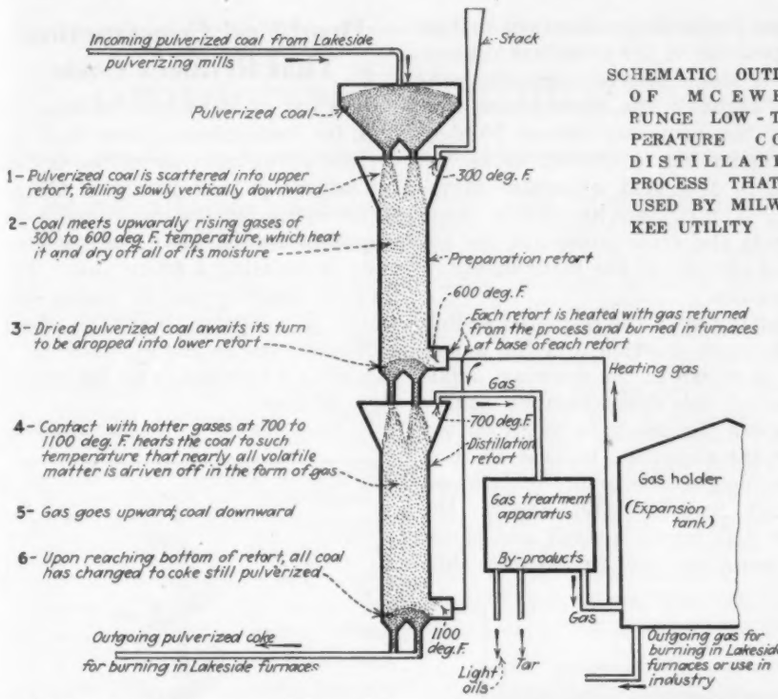
In starting on short circuit, the coils of the constant-current transformer are separated as far as possible to avoid the exceptionally heavy rush of current that would otherwise occur. If the rectifier circuit is open, the pilot light will go out, this also occurring when a spark jumps from the cathode to one of the starting anodes, but is accompanied by an ammeter reading. To restore the spark, the tube is shaken, and the pilot lamps should relight. Operation on short circuit is employed to warm up the tube and reduce the static that is often built up by inductive kicks due to current fluctuations, especially when the tube circuit tends to open. Static brought in on the direct-current line causes a discharge from the cathode to the starting anode, from anode to anode, or across the static discharger, causing the spark to be carried over into one of the starting anodes; this should be terminated by shaking the tube.

Too high or too low oil temperature may cause a tube to flash or puncture around the anode lead-in wire; furthermore, too high oil temperature will shorten the life of the tube by reducing the vacuum. It has been found that it is not advisable to shake the tubes while they are operating all right, because it may cause static and cause the tube to flash or puncture. If the tube flashes out, it is shaken. If a tube that operates all right on short circuit will not carry load, it is possible that the vacuum in the tube may be low, the tube may be too cold, or the dash pot may be too stiff. To establish normal operation, the short-circuiting plug can be left out and the arc-line and primary plugs inserted, the moving coil of the transformer pulled into the normal running position and the tube shaken. About one-half cylinder oil and one-half No. 6 transil oil is used in the dashpot, which is adjusted whenever the balance weight for the desired line current is adjusted. The adjustment is made with the valve closed by providing such a mixture of oil that the moving

Models Facilitate Designs



ENGINEERING designs are greatly facilitated in the Worcester (Mass.) Electric Light Company by the use of models, one of the latest being shown herewith in connection with studies now being made for a 13,200-volt network in the business district. The model shown duplicates a "super-manhole" on a scale of ¾ in. per foot, and it consists of a wooden box 12 ft. long, 9 ft. wide and 10 ft. deep, with scale models mounted within of a 300-kva. transformer bank, network protector, two ventilating fans, sump pump (not visible), ladder and racked and jointed cables made of copper tubing. Time is saved and accuracy of construction enhanced by the use of such models. George M. Hardy is general superintendent and A. D. Putnam the general engineer of the company under whose direction the models are made.


Incoming pulverized coal from Lakeside pulverizing mills
Stack
Pulverized coal
1- Pulverized coal is scattered into upper retort, falling slowly vertically downward
300 deg. F.
2- Coal meets upwardly rising gases of 300 to 600 deg. F. temperature, which heat it and dry off all of its moisture
Preparation retort
600 deg. F.
Each retort is heated with gas returned from the process and burned in furnaces at base of each retort
3- Dried pulverized coal awaits its turn to be dropped into lower retort
Heating gas
Gas
700 deg. F.
4- Contact with hotter gases at 700 to 1100 deg. F. heats the coal to such temperature that nearly all volatile matter is driven off in the form of gas
Distillation retort
Gas holder (Expansion tank)
Gas treatment apparatus
5- Gas goes upward; coal downward
By-products
6- Upon reaching bottom of retort, all coal has changed to coke still pulverized
Gas
Outgoing pulverized coke for burning in Lakeside furnaces
1100 deg. F.
Light oils
Tar
Outgoing gas for burning in Lakeside furnaces or use in industry

SCHEMATIC OUTLINE OF MCEWEN-RUNGE LOW-TEMPERATURE COAL DISTILLATION PROCESS THAT IS USED BY MILWAUKEE UTILITY

coil of the transformer will drop its full length of travel in two and one-quarter seconds. This adjustment is made at least once a month. Before checking this adjustment the coil is moved up and down several times to mix the oil thoroughly in the dashpot. If the dashpot action is too stiff, it might develop urging on the arc line, flashing of the tube, or cause a tube to drop the load. If the floating coil on the transformer floats within 1 in. of the stationary coil when the transformer is operating on the 80 per cent connection, the primary connection is changed to the full-load tap.

It has been found that the current in the arc-lamp circuit fluctuates more just after starting than during the remainder of the run, because the resistance of series luminous arc lamps is much higher at starting than after the lamp electrodes become warmed up. To stop a rectifier tube flashing, the rocker arm on the transformer is steadied, the oil temperature lowered, or static protectors applied. Overloading will sometimes start flashing of the tubes or cause them to drop the load.

To release the mercury from the inner walls of the tube the outside surface should be cleaned by washing in warm water and Bon Ami and the tube then placed in a box, the temperature of which is gradually raised to 250 deg. F. In cleaning the tubes they are held in a vertical position to avoid drying them out on short circuit again before putting them on a load.

Progress in Distillation at Milwaukee

ONE TON of $4.50 bituminous coal will yield 3 gal. of 15-cent light oils and 25 gal. of 7-cent tar and still reduce the heating value of the residue only slightly. Furthermore, storage, transportation and delivery charges on these valuable liquid byproducts are nil and the residue coke can be burned under power-station boilers in powdered form.

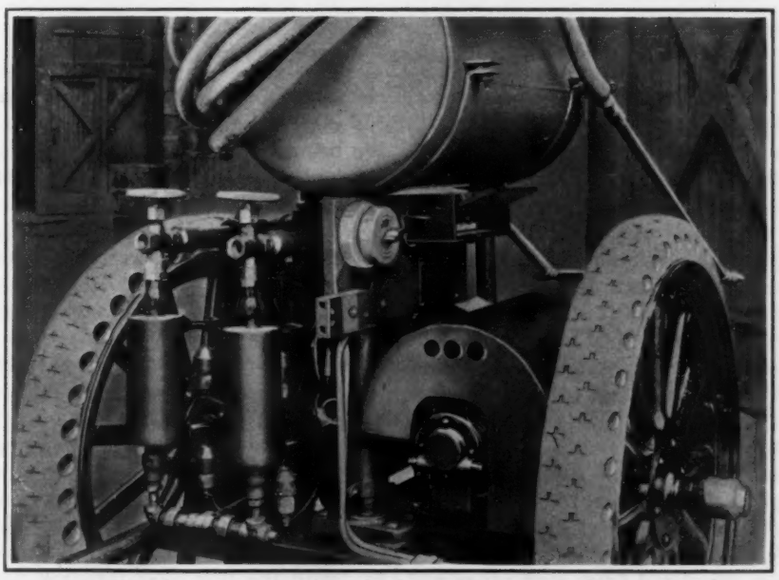
Because of these opportunities and the fact that coal has formerly constituted about 60 per cent of the major operating expenses of an electric service system, the Milwaukee Electric Railway & Light Company has been experimenting with a 210-ton McEwen-Runge low-temperature distillation plant for nearly a year. M. K. Drewry of the Milwaukee company reports that its performance has been very satisfactory, but complete test data are not yet available. This unit, which is shown in schematic form herewith, was designed so that it can later be used as one of a battery of eight units to process all coal used in the Lakeside station.

Electric Heat Helps Thermit Welding

ELECTRIC heat has now been applied in connection with thermit welding. The Metal & Thermit Corporation, Jersey City, N. J., has introduced heating units on its track-welding equipments to assist the vaporization of the kerosene oil used for preheating the work.

The oil is passed through the heating unit and is then mixed with compressed air at approximately 1-lb. pressure, after which it passes through a rubber hose to the torch used in applying heat to the rails.

The heating unit also acts as a resistor. The equipment is electrically operated from the standard 550/600-volt trolley circuit, and the group of two heating units is connected in series and placed in series with the 230-volt, direct-current motor that drives the compressor. With this arrangement a snap switch can be used to start the motor, as the heating units act as starting resistances.

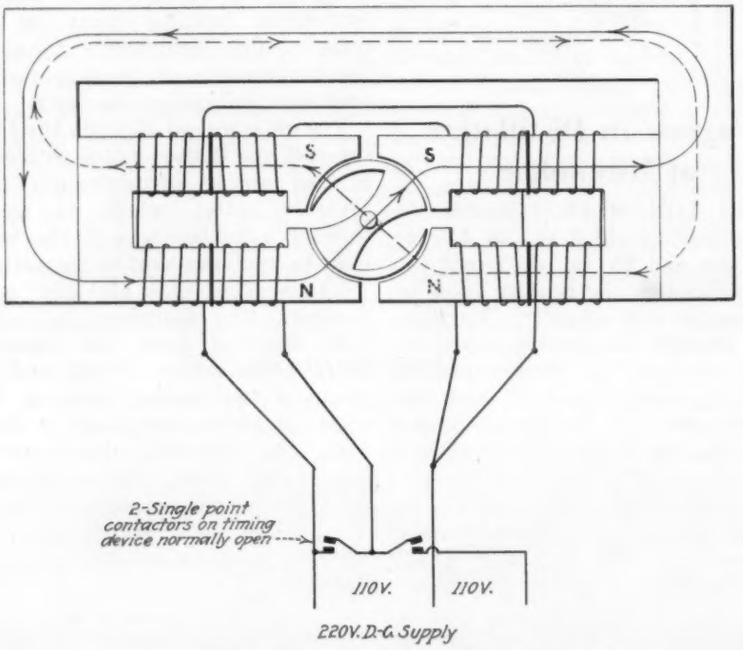


THERMIT WELDING EQUIPMENT USING TWO 1,200-WATT CAST-IN HELICAL SHEATH WIRE HEATING UNITS FOR VAPORIZING KEROSENE

Polarized Testing Switch Used by Detroit Company

BY HARRY HAMMOND
Meter Department, the Detroit Edison Company

IN THE routine calibration of rotating standards in the meter department of the Detroit Edison Company use is made of the polarized switch here schematically illustrated. The timing device used with it consists of a large graduated disk driven through gearing by a d.c./a.c. converter, the speed of which is controlled by a 60-cycle tuning fork (Leeds & Northrup). Two dogs are fastened to the periphery of the disk, one fixed and one movable, the space between them depending on the time lapse desired. These dogs, in passing, momentarily close a contactor, which permits actuating energy to flow in the switch.



SCHEME OF POLARIZED TESTING SWITCH

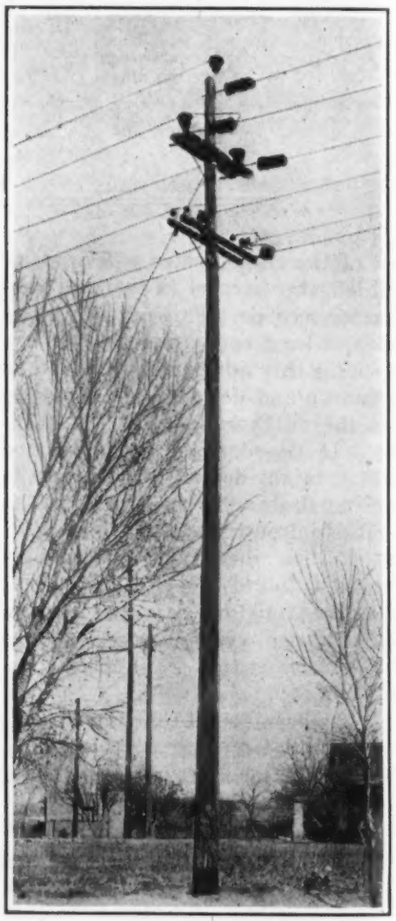
The switch consists of two horseshoe electromagnets placed between the open ends of a larger iron frame and with their pole pieces arranged to accommodate a rotatable armature. Each magnet has four windings, two directly connected to a direct-current supply and with their fluxes additive and two connected to a reversible current source and with their fluxes mutually subtractive. One winding of each kind is on each leg of the magnet. The armature of the switch carries on the end of its shaft (not shown in the drawing) two cross-pieces, insulated from each other and from the shaft and set one above the other to make a square cross. Four contact pieces are so disposed that in one position of the armature connection is made between opposite contacts through the cross-pieces and when the armature moves 90 deg. the connection is broken, to be remade in the next armature movement. The circuits handled by these contacts and cross-pieces are the potential circuits of the instruments in calibration.

Starting with the polarized switch in the open position and the armature as shown in the drawing, application of the direct-current supply energizes the magnets but does not affect the armature, because the pull of the magnets is evenly distributed through it. The first dog on the timer disk moves around and closes one contactor for an instant, thus closing the circuit of the polarizing coils. The magnetic flux, which in the previous closure of other contactor had traveled as indicated in the solid arrowed line in the drawing, now takes the path indicated by the dotted line and the armature flops into a position in line with it. The polarizing coils have magnetically bucked on one leg of each of the magnets and boosted on the other. The testing circuit is now closed and remains so for a definite length of time, depending on the relative positions of the two dogs on the disk. The second dog then passes over its contactor, which closes the polarizing circuit in the reverse direction, bringing the flux back into the path shown by the solid line and the armature back into the original position.

Dead-End Construction That Reduces Costs

A TYPE of dead-end construction for transmission lines that has certain advantages as well as certain limitations is that shown in the accompanying illustration, recently employed by the El Paso Electric Company in building a 60-kv. line. This type of construction is useful only where a condition involving short-radius curves is found, such as in following a railroad or an interurban right-of-way.

In such cases a single dead-end insulator string may be used to relieve the side strain on poles, pin type insulators, etc., in the curve. The method is to dead-end only toward the tangent at each end of the curve instead of dead-ending in both directions. By so doing the normal tension in the wire can be retained on the tangent and a reduced tension maintained in the curve calculated to relieve the strain on structures and insulators. On the line under consideration the saving amounted to approximately $50 at each dead-end position.



ONE-WAY DEAD-END CONSTRUCTION FOR SHORT-RADIUS CURVES

Commercial Activities and Public Relations

Wisconsin Views on Salesmen and Merchandising

SOME very pertinent and definite recommendations in regard to salesmen and selling organization were made by F. H. Evans, commercial manager of the Wisconsin Valley Electric Company of Wausau, Wis., in his report to the Wisconsin Utilities Association as chairman of its merchandising committee.

A salesman should receive a salary, and a commission not to exceed 15 per cent of the cash price of his sales, he recommends. A straight salary gives the salesman no strong incentive to volume sales, and commission alone does not tie him closely enough to the utility organization for him to feel the necessity of maintaining customer good will and furnishing of good service.

Territory should be divided into sections in order that salesmen can be protected, Mr. Evans continues. If a salesman is selling the general line of appliances, he should have from 1,200 to 1,500 meters in his territory. The average kilowatt-hour consumption per month per customer should also be taken into consideration. This recheck will show the territory having the users of the small heating appliances and better lighting equipment. In territories having a low average kilowatt-hour consumption special salesmen should be used. In towns of over 10,000 popuation he urges specialization on the major appliances. A special salesman should have from 2,500 to 3,000 meters in his territory. A file should be kept and each salesman's prospects protected for 60 days. A salesman should receive credit for all sales made in his territory providing a prospect card is on file and up to date.

Salesmen should make out daily reports giving the name and address of each prospect and the kind and type of appliance in which each prospect is interested, with remarks about interviews and the date for recall. This information should then be placed on prospect cards for future reference. As the recall appointments come up they are to be given to each salesman.

A customer survey should be made of all appliances being used in the home. The major appliances should show the kind and name of manufacturer. All new appliance sales should be added to the census card, and the cards should be kept up to date at all times. This record will furnish a complete mailing list that can be used during special sales and an inventory of the appliances that are connected to the lines.

The sales and display room can be used to advantage as a school while developing and training new salesmen. The average salesman starts out selling only washers, vacuum cleaners and all major appliances, because he is not schooled properly in the sale of smaller appliances and does not know the value of their sale to his company. Office sales consist largely of the smaller appliances. For this reason Mr. Evans' committee believes that the sale of heating appliances would be greatly increased if new salesmen spent time selling over the counter before going out in the territory.

Advertising is something that should not be neglected, because good, well-planned advertising pays. This expense should not exceed 3 per cent of the total sales, the report contends. In any kind of advertising, local conditions should be considered. Special advertising should be followed up by the local sales organization. Skillful newspaper advertising remains the best medium for the utilities.

Window Displays Help Sell Electric Refrigeration

TWO window displays in the electric shop of the Central Maine Power Company in Augusta have been effective in stimulating interest in this class of service. In one display the electric refrigeration idea was featured through the presentation of a "cold" atmosphere in the trim, and stress was laid upon the service rendered, the units and parts being set in the background. In another display a cabinet type unit was featured, emphasis being laid upon the appearance, compactness and utility of the design. The cabinet was placed at the focus of the trim without any other equipment to distract attention. George Smith, commercial manager of the company, believes that displays of this character quicken the interest of the local public in the subject and offset the cost of preparation.

WINDOW DISPLAY OF ELECTRIC REFRIGERATION BY CENTRAL MAINE POWER COMPANY

Employees Use Return Order Cards to Sell Lamps

ELECTRIC utilities operated by Charles H. Tenney & Company, Boston, began a campaign Nov. 1 to sell 60-watt lamps in cartons through return order cards and by employee co-operation on a commission basis for sales.

About 120,000 customers are in-

cluded. The cards, each bearing an employee's name, are sent to customers by mail with bills and are turned in by these employees. As the order cards are returned and the lamps delivered the employee concerned is credited 25 cents per carton. Lamps are sold at regular prices, but may be paid for on a three months' basis in connection with the lighting service billing at that time. In one company one employee sold 35 cartons of lamps the first day of the campaign, which is to last through the month. The bonus applies only to the 60-watt size of lamp, according to Cyrus Barnes, general sales manager of the Tenney organization. This sales plan has produced splendid results.

Electric Furnace for Heating Drill Steel

Oil Displaced with Successful Arcless Furnace on Hydro-Electric Tunnel Job—Many Advantages Claimed

BY HAROLD K. FOX
Superintendent of Construction San Joaquin Light & Power Corporation, Fresno, Cal.

IN STARTING construction of the tunnel on the Balch hydro-electric project of the San Joaquin Light & Power Corporation, the desire to eliminate hauling oil over many miles of mountain road led the writer to consider the use of an electric furnace for heating drill steel. Oil furnaces have been quite generally used for this work but have not been entirely satisfactory due to lack of heat control. Electric power was required for other purposes, hence no extra expense would be entailed in making energy available for an electric furnace.

Many electric furnaces had been used for heating metals, but nothing suitable for this purpose was available. Several manufacturers were consulted but turned the proposition down. An experimental furnace was built, which proved inefficient, but it did heat steel. Many problems relating particularly to drill steel were discovered, and experts were started on the design of a real furnace. The second furnace was a great improvement over the first but also developed weaknesses after being in service for a time. It was concluded that radical departures from ordinary furnace design were necessary and as a result the present and successful furnace* shown in Fig. 1 was produced. It has been in operation 24 hours a day for several months and has given thorough satisfaction.

CONSTRUCTION OF FURNACE

The furnace as finally built contains three 40x1⅝-in, O. D. Globar elements of 17-kw. capacity each, running lengthwise through the furnace. Two units are located in the top of the heating chamber above the drills, and the third unit was placed below the drills in such a manner that the scale flaking off the drills cannot possibly come in contact with the heating element. The furnace is designed to reach a maximum of 2,300 deg. F., and provision was made for a fourth unit in the bottom in case increased heating capacity should be necessary. So far, however, this has not been required.

*Patents have been granted the author on the important features of this furnace.

FIG. 1—THE SUCCESSFUL ELECTRIC FURNACE FOR FORGING AND TEMPERING ROCK DRILLS

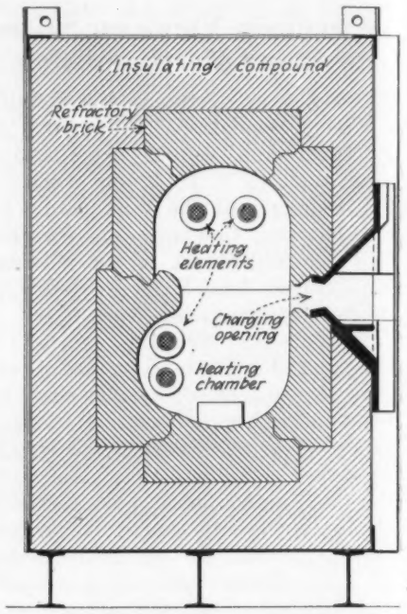


FIG. 2—CROSS-SECTION OF ROCK DRILL-HEATING FURNACE

The heat chamber is 36 in. wide, 15 in. deep and 29 in. high and consists of ten tiles only, each of which is 4½ in. thick and of considerable weight. Tiles in corresponding positions in the furnace are symmetrical and can be interchanged. A special curvature was designed for the tiles in order to increase radiating efficiency, and the number was kept to a minimum to prevent shifting caused by external vibration. The working opening has a length of 24 in. and a maximum height of 3 in. and tapers in so that the drill heads can be seen at all times. Fig. 2 shows a cross-section of the furnace. The steel structure is extremely sturdy to permit transporting without disrupting the internal structure through deflection of the steel members.

The three elements are connected in closed delta for 110-volt operation. One element is on continuously, whereas the other elements control the temperature by "on" and "off" operation of a two-pole contactor. A Leeds & Northrup control automatically maintains the required working temperature (approximately 2,250 deg. F.).

Detailed studies were made of the furnace in operation, some of which are shown in Tables I and II. Based on the required speed of heating

TABLE I—CAPACITY OF ELECTRIC FURNACE BASED ON HEATING REQUIREMENTS FOR DRILLS

Portion of Drill	Operation	Length of Heated Portion, In.	Weight of Heated Portion, Pounds	Temperature of Drill, Deg. F.	Temperature of Furnace, Deg. F.	Heating Time, Minutes	Number of Drills per Charge	Number of Charges per Hour	Number of Drills per Hour
Head	Forging	4	1.5	2,200	2,250	5	11	12	121
	Tempering	¼	0.5	1,000	2,250	2	8	30	240
Shank	First forging	8	32	2,200	2,250	6	4	6.6	26
	Second forging	8	32	2,200	2,250	3	4	6.6	26
	Tempering	8	32	1,500	2,250	5	8	12	96

TABLE II—KILOWATT-HOUR CONSUMPTION FOR 24-HOUR OPERATION

	Day Shift					Night Shift					Total Time in Hours
	Head		Shank			Head		Shank			
	Forging	Tempering	Forging	Tempering	Total	Forging	Tempering	Forging	Tempering	Total	
Average number of drills	308	316	7.3	14.5		280	268	3.6	2.3		
Number of drills per hour	121	240	26	96		121	240	26	96		
Operation time in hours	2.55	1.32	0.3	0.15		2.3	1.12	0.14	0.02		
Preheating time of furnace	0.25	0.16	0.25	0.16		0.25	0.16	0.25	0.16		
Total time of full heat	2.80	1.48	0.55	0.31	5.14	2.55	1.28	0.39	0.18	4.40	9.54
Total operation time per 24 hours											9.54
Total idle time per 24 hours											14.46
Kilowatt-hour consumption of furnace during 9.54 hours' operation (42 kw.)											400.6
Kilowatt-hour consumption of furnace during 14.6 hours' idle run (14 kw.)											202.4
Average kilowatt-hour consumption of furnace per 24 hours											603.0

operations, together with the necessary temperature rise of the drill, theoretical heat requirements were calculated. This showed that approximately 17 kw. is required for continuous sharpening and 42 kw. for continuous tempering of the drill heads. For forging the shanks 65 kw. is required for the first forging, 42 kw. for the second forging and 17 kw. for tempering.

ADVANTAGES OVER FUEL-FIRED FURNACES

There are several advantages of this furnace over fuel-fired furnaces:

1. Better quality forging and tempering due to heat control not possible in fuel furnaces.

2. Equal or less cost of operation; no compressed air required; long life of furnace lining; and no abrasive action of flame on lining.

3. Less consumption of drill steel due to less scaling; no chemical action in heating; and less breakage and sharpening on account of uniform heating and tempering.

4. Elimination of excessive noise, heat and dirt in the shop.

The working conditions have been on a double heading of 12x12-ft. tunnel with 24-hour driving in hard granite. The furnace, working two shifts, will handle nicely steel for drilling 36 holes in the working face with three or four rounds of shooting in 24 hours—in fact, it will heat faster than the steel can be put through a sharpener. This speeds up operation and reduces cost.

Special acknowledgment is made to A. Pfau, Jr., of the American Resistor Corporation; James H. Knapp, of the James H. Knapp Company; E. L. Fox, tunnel superintendent, and B. E. Anderson, electrical engineer, in the development of this furnace.

Electric Kitchen for Distribution Department

BY J. E. JORDAN
Superintendent of Distribution El Paso Electric Company, El Paso, Tex.

THE distribution department of the El Paso Electric Company maintains the electric kitchen shown in the accompanying illustration in its service building for special use. In case of a storm or other emergency at night the watchman, who formerly served as camp cook, opens up the kitchen, which is conveniently located in the building, and serves sandwiches, coffee and pies steaming hot for the men as they come in, perhaps wet and chilled from exposure. Not only are the men appreciative of this service but it adds greatly to the morale of the organization.

The distribution service building is frequently the center of company social and educational activities, and on such occasions hot refreshments can be prepared on short notice.

The equipment consists of an electric range, an electric refrigerator, a full complement of cooking utensils and a small stock of staple foodstuffs.

PREPARING HOT REFRESHMENTS IN AN ELECTRIC KITCHEN FOR EMPLOYEES DURING EMERGENCIES

Industrial Heating Bulletins to Help Load Building

TO POPULARIZE the advantages of industrial electric heating among manufacturers and commercial establishments in eastern New England a bulletin has been started under the auspices of the industrial heating division of the Edison Electric Illuminating Company of Boston. This bulletin is designed to tell condensed stories of industrial electric heating achievements in language easily understood by prospective customers and existing users of this class of service.

The material will be presented as free from technicalities as possible and at the same time will carry enough information of value to tempt prospects to keep it in their files for ready reference. It is not unlikely that other companies in New England will disseminate similar material among their customers and prospects, probably under local date lines and with such local modifications as may be required to present the argument for electric heating in a manner consistent with local variations in industries, rates and service requirements.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Layout of Steam Power Stations.—F. OHLMÜLLER.—Economical use of the available space and the possibility of future additions are always the fundamental considerations in the layout of power stations. For steam plants two basic arrangements are possible—with the boilers parallel or at right angles to the engine room. Formerly the parallel method was usually found in smaller plants, while large plants had their boilers at 90 deg. to the turbine room. Many factors bear upon this choice, such as the nature of the coal, type of firing, size of boilers, etc. The author describes the effect of these factors and substantiates his statements by referring to five modern power stations. He comes to the conclusion that with a proper choice of boiler size an arrangement with one row of boilers parallel to the row of generators will always be found possible and that this layout has the greatest number of economical advantages.—*Siemens Zeitschrift*, September, 1926.

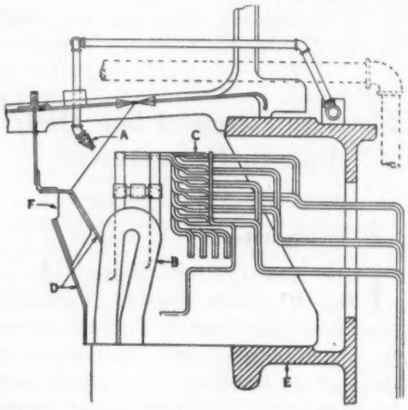
Transmission, Substations and Distribution

Automatic Substations on Pacific Electric Systems.—S. H. ANDERSON.—Automatic substations have now been operated on the Pacific Electric systems for seven years with entirely satisfactory results, according to the author of this paper. During this period the use of automatically operated equipment has become general among the electric railways, thereby substantiating the earlier claims made in favor of this type of switching and control equipment. The Pacific Electric Railway operates 1,160 miles of standard-gage-equivalent single track, serving Los Angeles, Orange, Riverside and San Bernardino Counties, including some 55 incorporated cities, and provides a highly developed and extensive passenger, express, mail and freight service to all parts of the territory served. The equipment includes 920 passenger cars, 2,900 freight cars and 55 electric locomotives. The extent of the system makes of major importance the problem of providing an uninterrupted supply of electrical energy and avoidance of traffic delays. The author takes up in detail the general types of construction of substations used on this system and mentions the features of their operation and maintenance.—*Electric Journal*, October, 1926.

Ground Protection on Parallel Lines.—F. AHRBERG.—According to an arrangement suggested by Holmgren, a combination of current and potential transformers can provide selective feeder protection on a double three-phase line. The performance of this protective system when a ground appears at various points of the lines is investigated. It is found that the method functions equally well without or with a so-called quenching transformer, and whether this transformer is installed at the beginning or the end of the line. The protective system is applicable for two or any higher number of feeders and insures perfect selectivity regardless of where the ground occurs.—*Elektrotechnik und Maschinenbau*, Aug. 22, 1926.

Generation, Control, Switching and Protection

Fire Protection of Waterwheel-Type Generators.—J. A. JOHNSON and E. J. BURNHAM.—The problem of protecting generators against fires of internal origin is closely associated with ventilation. The fact that most waterwheel-driven generators have the open type of cooling system makes the use of the protective method ordinarily employed in steam-driven machines impossible without considerable modification. The purpose of this article is, according to its authors, to describe the fire prevention and protective measures which have been successfully applied to waterwheel generators of large rating belonging to the Niagara Falls Power Company. From the standpoint of internal fires the hydro-electric machine differs from the steam-driven turbine machine in several important respects: (1) Much larger diameter of rotor and stator; (2) open construction, with open ventilating systems; (3) use of natural drafts created by the rotating parts for cooling purposes. A detailed description of a system of air baffles and fusible sprinkler heads which permit the application of the water solely to the region of the fire is contained in this paper, together with results of a variety of tests made during the design of the devices used.—*Journal of A.I.E.E.*, November, 1926.



SECTIONAL VIEW OF GENERATOR SHOWING RELATIVE LOCATION OF END WINDINGS, CONNECTIONS AND SPRINKLER

Units, Measurements and Instruments

Some Graphical Solutions of Alternating-Current Curcuits.—F. W. LEE.—This paper presents a graphical method founded upon non-Euclidian geometry for the solutions of alternating-current circuits; the method is developed and the results discussed. The application of these transformations is shown graphically by numerous examples throughout the paper. Certain characteristics of circuits are identified which tend to simplify the graphical solutions. The analysis, according to the author, indicates how, with the aid of a few elementary transformation theorems, the operation of electric circuits, machinery and vibrations of all kinds may be visualized and their limitations and possibilities discerned without the aid of extensive mathematical formulas. It will show, for example, how a system may be operated with greatest efficiency or flexibility and what units added to this system will give best results.—*Journal of A.I.E.E.*, November, 1926.

Theory of Overlapping Joints.—RAYMOND M. WILMOTTE.—Melsom and Booth have investigated experimentally the theory of overlapping joints, dividing the resistance of the joint into two parts—one representing the resistance due to the contact and the other that due to the stream lines of the current at the joint. In the present paper the latter part is obtained theoretically in terms of elliptic functions. The result is expanded and, according to the author, leads to a very simple formula, with which the experimental results of Melsom and Booth are found to agree.—*Journal of Institution of Electrical Engineers (England)*, October, 1926.

Motors and Control

Electric Forging Press.—A. FRIEDERICI.—To carry out heavy forging operations on hot steel bars, requiring 150 tons to 10,000 tons pressure, straight hydraulic or steam-hydraulic presses are in general use. Particularly in the smaller sizes, up to about 1,000 tons, the operation of this type of press is too slow and uneconomical owing to the unavoidable losses it entails. An electrically driven, directly acting press is described in this article which answers the purpose much better and which is available for pressures between 250 tons and 600 tons. An adjustable speed direct-current motor drives over a double-reduction gear, without added flywheel, a crank shaft which actuates a heavy-built ricker arm to the shorter lever of which is attached the vertically movable press bar. Between the crank and the longer lever of the rocker arm a yielding member in the shape of a hydraulic piston is interposed. A small auxiliary motor serves to adjust the stroke of the press bar. A number of energy-operated contactors in series with the main motor automatically reduce the motor speed for heavier work. The rated speed of 1,000 r.p.m. of the motor can thus be reduced to as low as 250 r.p.m. with proportionally increased torque.—*Zeitschrift des Vereines Deutscher Ingenieure*, Sept. 25, 1926.

A Unity-Power-Factor Motor.—In response to the demand for a compensated-type induction motor having a high inherent power factor, there has been developed an "all-watt" motor to give the desired results, which it is said are obtained by incorporating in the motor an exciting device consist-

ing of a commutator connected to a low-voltage winding similar to the exciter armature of a synchronous machine. The compensator is really a phase advancer built into the machine, its winding consisting of a few turns of heavy-gage wire. This winding is never subjected to high pressures, thus rendering it practically immune from electrical breakdown. The commutator and exciting winding are disconnected entirely during the starting period. and the starting operation is similar to that for the ordinary induction motor. When the machine has reached full speed, the compensating device and commutator are automatically switched in by moving the starting switch to the final position. No wattless current will be taken from the line at normal working range between three-quarters load and 25 per cent overload. On half-load there is a small wattless current, but a high power factor is maintained. The patented compensating device does not in any way, it is claimed, interfere with the reliability and simplicity of working of the motor, while the "pull-out" torque is increased and the size of the motor is held the same.—*Electrical Review* (*England*), Oct. 1, 1926.

Electrophysics, Electrochemistry and Batteries

Acid Zinc-Plating Baths.—M. R. THOMPSON.—In a study of acid zinc-plating baths it was not found possible, according to the author, to increase materially their throwing power, chiefly because of the low cathode polarization which they possess. It was found, however, that simple baths of much higher conductivity than those commonly used may be prepared in which satisfactory deposits can be produced at unusually high current densities. Such baths may contain a moderate concentration of zinc chloride, a high concentration of sodium or ammonium chloride and a small concentration of aluminum chloride.—*Paper presented before American Electrochemical Society*, October, 1926.

Electrochemical Potentials of Carbon and Chromium Steels.—C. BENEDICKS and R. SUNDBERG.—The aim of this paper, according to the authors, is exclusively that of giving trustworthy data concerning the electrolytic potential. The program for the research is the determination of the potential in an aqueous solution—(1) in presence of free hydrogen; (2) in presence of free oxygen. The determinations were carried out on two series of carbon steels and also on a series of "stainless" steels. From the investigations so far as they have progressed the conclusion to be deduced is that chromium occurs in a dissolved state at a low carbon content, even after slow cooling. Unquenched specimens, containing about 13 per cent chromium, were found to possess a resistivity as high as about 62 microhms per centimeter at a very low carbon content. On increasing the carbon content this resistivity value, however, was considerably lowered. The addition of an increasing amount of carbon apparently causes a part of the dissolved chromium to be precipitated.—*Engineering* (*England*), Oct. 1, 1926.

Traction

Design of Storage-Battery Locomotives for Use in Coal Mines.—L. MILLER.—This paper deals with the general considerations which affect the design of a battery locomotive for use in mines. Detail points in the design are dealt with on broad lines, and the results are given of certain tests designed to compare the coefficient of adhesion obtained with specially prepared wheels and standard wheels on rails prepared to represent conditions met with in practice. Various methods of obtaining flame-proof inclosure of the electrical apparatus are described.—*Journal of Institution of Electrical Engineers* (*England*), October, 1926.

Unusual Type of Storage-Battery Locomotive with Gas-Electric Auxiliary.—W. D. BEARCE.—This locomotive, incorporating features of both the storage battery and the gas-electric drive, has, according to the author's paper, a number of novel features which make it particularly adaptable to switching service. The control is so arranged that power can be taken entirely from the storage battery or in part from a gas-engine-driven generator. It is intended to use the storage battery as a source of power for the traction motors under ordinary circumstances. The battery is made up of 120 cells with a capacity of 616 kw.-hr. and capable of charging at rates up to 846 kw. These storage batteries can deliver 1,000 hp. to the driving motors, a feat that, it is said, can be duplicated by no other type of self-propelled locomotive of equal weight.—*General Electric Review*, November, 1926.

Telegraphy, Telephony, Radio and Signals

Power of Fundamental Speech Sounds.—C. F. SACIA and C. J. BECK.—This paper describes the continuing work on speech power by means of oscillographic studies of vowels, semi-vowels and consonants. A previous paper considered the characteristics of a few individual sounds from the power standpoint, but the principal emphasis was placed upon speech as a whole. In this later analysis sounds are considered individually on the basis of instantaneous and mean power. A practical application of the results is suggested by the authors.—*Reprint B-206, Bell Telephone Laboratories.*

Establishment of Radio Standards of Frequency by the Use of a Harmonic Amplifier.—C. B. JOLLIFFE and GRACE HAZEN.—A method is described for measuring the ratio of a radio to an audio-frequency by the use of a harmonic amplifier. The harmonic amplifier makes it possible to use harmonics of a very high order from a known low-frequency source, such as a standard tuning fork. The method as outlined by the authors consists essentially of the production of harmonics of the fundamental frequency of an alternating current by means of the non-linear characteristics of electron tubes, the selection of any desired harmonic by means of tuned circuits and its amplification to sufficient power to operate a standard wave meter. The harmonic amplifier consists of two units, one having a range from 8 to 450 kilocycles, the other from 400 to 4,000 kilocycles. The first unit supplies a harmonic which is used as the fundamental for the second unit. To the harmonic amplifier a preliminary calibration is given, so that the harmonic multiples can be readily determined. A fixed-frequency generator, such as a piezo oscillator, may be standardized with the aid of an auxiliary device to determine the frequency of the beat note occurring between a harmonic of the amplifier and the fixed frequency. The device used for this purpose is called a sonometer. It consists essentially of a steel piano wire mounted horizontally across two movable knife edges with a known tension applied. The wire vibrates when its frequency is equal to the applied frequency of the source. The frequency of vibration may be computed from the length, tension and mass per unit length of the wire. Two audio-frequencies may be compared very accurately, according to the authors, by the use of the harmonic amplifier and sonometer.—*Scientific Papers of the Bureau of Standards, No.* 530, July 15, 1926.

Miscellaneous

Rural Electric Supply in Ontario, Canada.—This is the second of two articles by a New Zealand electric supply engineer which analyze the operations of the Hydro-Electric Power Commission of Ontario. The first, dealing with the bulk supply undertakings of the commission, appeared in the August number. This article deals with the rural electrification undertakings, discussing the only field in which it is considered the commission encroaches into the domain of retail supply.—*Electrical Engineer of Australia and New Zealand*, Sept. 15, 1926.

Electrical Accidents.—K. ALVENSLEVEN.—The author claims that the many data available in the extended literature on this subject giving the ohmic resistance of the human body are of little value, because such resistances cannot be measured or defined as can those of a piece of wire, for example. Voltage and frequency have a very great influence upon the values obtained. Generally the resistance assumed is too high, and consequently the current passing through the body too low. In many cases electrical accidents have caused secondary actions which permitted a rather close estimate of the current passing through the victim. Fuses of certain amperage were found melted and automatic circuit breakers set for a certain current tripped out. It was thus found that in an accident involving 15,000 volts 4 amp. must have passed the body from hand to hand, representing 3,750 ohms. At an accident involving 40,000 volts a 50-amp. switch tripped, calling for only 800 ohms resistance from hand to foot. Based on a large collection of data from Sing Sing, the head-to-foot resistance may be assumed as 250 ohms at 2,000 volts. At commercial frequency, with the heart in the current path, a current of up to 0.05 amp. may be considered as harmless. One ampere is certainly fatal to human beings.—*Elektrotechnische Zeitschrift*, Aug. 26, 1926.

Scientific & Industrial Research

[When investigations which have been completed are, in the opinion of the editors, of wide enough interest to the field we serve, details thereof will be presented in other parts of this paper. Contemplated research or that which appears to have limited appeal will be only briefly reported in this section, but details may be had by communicating with the investigator or institution named in the report. Readers are referred to the department "Digest of Electrical Literature" for investigations reported in other journals. The news and engineering sections should also be followed for research reported before technical societies.]

Research Completed

Insulators, Suspension Type, Protection from Power Arcs

A new idea in a top and bottom connection for link type insulators has been developed, having for its purpose a full protection to the links from the destructive effects of power arcs. This device consists of a fan-shaped projection on each side of the top and bottom adapter connections, extending beyond the links and forming an effective protection from burning. The flashover characteristics of the string are not appreciably altered by the use of this device. A similar device, suitable for attachment to the older type of end connection, has also been developed where trouble of this nature has been experienced. —*R. Thomas & Sons Company, Liverpool, Ohio.*

Line Material, Effect of Weather Upon

Advantage was taken of the dismantling of the old transmission line entering Toronto along the shore of Lake Ontario to study the effects of weather upon galvanized steel and concrete and to gather information in regard to the performance of transmission-line hardware. Some valuable information was obtained from this inspection.—*Hydro-Electric Power Commission, Toronto, Ontario.*

Paper-Tearing Machine

This machine was evolved, in connection with the buried cables research, to assist in the determination of the safe temperature. It was found necessary to have some means of estimating quantitatively any deterioration in the mechanical properties of paper as the result of exposure to heat. The method adopted was to measure the energy required to pull a wire loop across a short length of the strip and to express this energy as ergs per centimeter width of the paper torn through. This amount of energy is deduced from the retardation experienced by a falling pendulum which pulls the wire loop through the paper. The pendulum actuates a pointer which moves over a scale calibrated to show directly the energy used.—*National Physical Laboratory, London, England.*

Spark, Characteristic of

A study is being made of several types of oscillographic records to determine in detail the variation in the conductance of the spark, as a function of its history in terms of time and the previous flow of current through it.—*W. P. Boynton, University of Oregon, Eugene.*

Thermo-Electric Microscope

The Endell thermal microscope serves for the direct study at high temperatures of chemical and physical processes by observation in transmitted or incident light, natural as well as polarized. It is therefore more especially adapted for ascertaining temperatures of fusion and the transformation temperatures of crystals, as well as for the following investigations of technical nature: For watching the flow occurring in fine ceramic and refractory materials, in raw mixtures for the manufacture of Portland cement, in ores and metallurgical products, for controlling the process of devitrification in optical and other kinds of glass, and the elimination and resorption of clouding media in enamels.—*E. Leitz, 60 East Tenth Street, New York, N. Y.* [One of the principal advantages of electric heating or annealing is an accurate control of temperature, so that an instrument for accurate measurement of high temperatures is of interest to the industry.—*Editor.*]

Tungsten Deposit, Effect of, on Electric Lamp Bulb

An electric lamp, the life history of which had been carefully recorded, was removed from service. The bulb was cut from the base, and a small electric lamp placed inside the blackened bulb. The effect of the tungsten deposit on the observed color temperature of the source and on the transmission of the glass was measured at various places through the bulb. The data will have an important bearing on the use of gas-filled lamps as standards of color or intensity.—*Bureau of Standards, Washington, D. C.*

In Progress or Purposed

Motors, Alternating-Current, Secondary Currents in

It is proposed to determine analytically and check with the oscillograph rotor currents in the secondaries of single-phase motors with squirrel-cage windings; also in the amortisseur windings of self-starting polyphase synchronous motors.—*G. F. Corcoran, I. C. Benson and H. R. Reed, University of Minnesota, Minneapolis.*

Oils, Transformer

Considerable study was given to the methods used by different authorities for sludging oils, and as a result an apparatus modeled after the Brown-Boveri, but using glass containers instead of copper, was built and is now being experimented with. It consists essentially of a number of 1,000 cu.cm. glass graduates set in an oil bath and provided with automatic temperature control by which a uniform temperature can be continuously maintained within 1 deg. C.—*Hydro-Electric Power Commission, Toronto, Ontario.*

Paper, Conditioning and Testing Cabinet for

A cabinet has been designed in which the atmosphere is kept at a constant relative humidity by means of the well-known method of exposing the air to a sulphuric-acid solution of definite concentration. The specific gravity of a sulphuric-acid solution is a sufficient index of its relative vapor pressure. In order to carry out the folding test without opening the cabinet, flexible sleeves are provided which terminate in rubber gloves. By this means all necessary operations of inserting the test strip, adjusting the tension, starting and stopping the tester, etc., are effected almost as easily as if one were inside the cabinet.—*Bureau of Standards, Washington, D. C.*

Poles, Treated and Untreated, Service Tests on

The principal conclusions so far reached are as follows: (1) Untreated poles set green will generally give a longer life than untreated poles set after seasoning. (2) An open-tank butt treatment with creosote is more effective than any other kind of treatment included in the experiments. (3) The choice between butt treatment and full-length treatment should depend upon the region in which poles are to be used. (4) A two-coat brush treatment is better than a single coat of the same preservative. (5) In general poles given a two-coat brush treatment with carbolineum or creosote were in better condition than poles given brush treatments with other preservatives. (6) Poles given an open tank butt treatment with zinc-creosote were in better condition than poles given a similar treatment with zinc chloride alone. For further details see N.E.L.A. Report No. 256-34.—*R. M. Wirka, U. S. Forest Products Laboratory, Madison, Wis.*

Rail Joint, Welded, Tests Show Resistance to Impact

In a small house in the woods, where the noise of the test will be least disturbing, the Bureau of Standards is seeking to determine which type of welded rail joint will last the longest under the impact of street-car traffic. Specimens of every type in common use are being subjected to very rough treatment in order to determine their relative durability. The specimen under test consists of two short lengths of rail fastened together with a joint of the type to be studied. This specimen is mounted on two supports which in turn rest upon a heavy spring-supported anvil. A power hammer weighing 400 lb. strikes a blow on the joint once a second, being driven by an electric motor and cam shaft. The succession of heavy blows on the joint produces an effect similar to that from the wheels of cars running along the track, and the number of blows required to break the joint indicates its relative strength. The test is a noisy one, even worse than the noise due to flat-wheeled cars or cupped rails. This test, which forms a part of a thorough investigation of rail joints, is being carried out in co-operation with the welded rail commission of the American Bureau of Welding and the American Electric Railway Association. Four common types of welded joints are being investigated. These are the fishplate weld, in which the ends of the rails and a pair of fishplates attached to their sides are welded together with an electric arc; the thermit weld, the butt weld and the cast-iron weld. Of these four, the fishplate weld is most used. The butt weld can be used only in new track, as it requires the ends of the rails to be pressed together and melted with an electric current. The thermit weld is used to a certain extent and consists in pouring molten metal into the joint, the steel being melted by the thermit process.—*Department of Commerce, Washington.*

Steam Research

At the Massachusetts Institute of Technology pressure-temperature-volume measurements were continued and trouble in obtaining air-free and gas-free water was overcome. At the Bureau of Standards the special calorimeter and appurtenances have been perfected and set up for determining heat content, entropy and specific heat of saturated liquid and vapor, the vapor pressure, specific volume at saturation and heat content of superheated vapor. Already the "steam tables" have been notably extended and still greater extensions are in prospect. This research is making contributions of fundamental knowledge of great value in the further development of the art of steam engineering.—*Engineering Foundation, 33 West Thirty-ninth Street, New York, N. Y.*

Turbines, Hydraulic, Propeller-Type

During the year particular attention was devoted to the development and testing of propeller-type runners, with the result that higher efficiencies have been obtained and also the specific speed has been increased. The model runners were constructed with separate vanes attached to the hub through a shank, so that it was possible to vary the angle of the vanes and also to investigate the performance of different numbers of vanes. In these tests we have covered such a wide range in specific speeds that the gap between the Francis runner and the propeller-type runner has been successfully closed.—*William Cramp & Sons, Philadelphia, Pa.*

Suggestions for Research

Plating with Chromium

An outstanding development in electrodeposition during the past year has been made in chromium plating. There are still many problems requiring study before its general application will be entirely feasible. There are at least twenty laboratories in the country now engaged in the study of chromium plating, and while it is not yet in extensive use, the indications are that it will soon find many important industrial applications. Chromium is a material of extreme hardness and is also notable for its resistance to tarnish and to chemical action.—*G. W. Vinal, Bureau of Standards, Washington, D. C.*

Transmitter, Broadcast, Scientific Problems of

The problems of successful broadcast transmission awaiting solution are the determination of the laws of propagation of electromagnetic waves of different lengths, the measurement of atmospheric disturbances and their variation with place and time, and the investigation of the fluctuations of the received signal strength ("fading."). Regarding the transmitter, the author discusses the modulation process, the control of the wave length by piezo-electric crystals and the acoustics of the studio.—*K. W. Wagner, in Teleg. u. Fernspr. Techn.*, 1926, Vol. 15, p. 76.

News of the Industry

New Locomotive Ready

Westinghouse Completes First of A.C.-D.C. Engines It Is Building for the Great Northern Railway

THE first of the motor-generator locomotives to be built by the Westinghouse Electric & Manufacturing Company for the Great Northern Railway has been completed and was inspected at Pittsburgh this week by prominent railroad officials. This locomotive is declared capable of hauling 200-car trains and is regarded as a noteworthy achievement in the history of electric traction. It will be used in the State of Washington on all trains operating on the electrified division of the Great Northern, which runs from sea level to the Cascade Mountain and includes one of the longest and steepest mountain grades in America. The 24-mile section over which the locomotive will first operate runs from Skykomish, Wash., to the eastern portal of the Cascade tunnel.

"This locomotive," said F. H. Shepard, director of heavy traction with the Westinghouse company, "makes it possible to combine the principles of high-voltage alternating current, transmitted over great distances from hydro-electric stations, and the direct-current motor. Power is drawn from an overhead trolley which carries an 11,000-volt alternating current. This is then passed through a transformer and motor-generator set by which it is converted into direct current for the traction motors. Having the facilities to convert power embodied in the locomotive eliminates the requirement of numerous substations for this purpose erected at intervals along the right-of-way. Furthermore, the power is converted just as it is used by the locomotive.

"The motor-generator locomotive is a development from the first of this type built in 1925, at the Ford plant in Detroit, with equipment of the Westinghouse company and now in use on the Detroit, Toledo & Ironton, Henry Ford's railroad.

"A wide range of operating speeds is available with this new engine. In the case of the Great Northern, full power at any speed from 2 miles to 35 miles per hour can be obtained, while the ordinary direct-current motors have a very limited number of running speeds.

"In order to negotiate curves, the locomotive is divided into two cabs. It has a total length of neary 100 ft. and weighs 680,000 lb. It can exert 7,000 hp. under maximum conditions, which makes it rank with the most powerful electric locomotives ever built and far outrank any steam locomotive. The locomotive has a continuous rating of more than 3,500 hp. at a speed of 15 miles per hour, has eight driving motors and operates from an 11,500-volt, 25-cycle overhead trolley.

"An important feature is the system of regenerative braking effective at all speeds by which the heavy trains can be taken down the mountain grades without the use of airbrakes. This is accomplished by utilizing the traction motors as generators. The descending train generates power which is fed back into the trolley and to the power system for any other trains or general power use, while at the same time controlling the speed of the train.

"Early extension of electrification in the western part of the United States may well be predicated on the development and application of this type of locomotive."

Federal Power Board Meets

Agreement on White River May Be Negotiated—Wolf River License Is Granted—Other Projects

WHEN the Federal Power Commission met on Nov. 17 to consider the applications of the Ozarks Hydro-Electric Power Company and the White River Power Company for rights on the White River in Arkansas, a postponement was asked by each company. It is understood that negotiations looking to the settlement of the conflicting applications are in progress. It will be remembered that the rivalry between these companies is of long standing, both claiming to inherit the rights of the original Dixie Power Company. The White River company is a North American subsidiary, while the Ozarks company is an H. C. Couch concern.

At the meeting the commission authorized a license for the Wisconsin Power & Light Company covering a project on Wolf River, in Shawano County, Wis. The proposed dam will back up water to Keshena Falls and will affect a small portion of the Menominee Indian reservation (see ELECTRICAL WORLD for Oct. 23, page 873). A condition of the license will require the company to pay due regard to scenic beauty in the carrying out of its project.

A preliminary permit was authorized for the Fitkin Utilities, Inc., covering a project on the Santa Fe River in Florida. A dam 20 ft. high and 2,000 ft. long, creating a reservoir 22 miles in length, will be constructed. The primary power to be made available will be 1,650 hp. A preliminary permit also was authorized for the South Side Power Company covering a project at Talleys Falls in the Roanoke River in Virginia. The dam is to be 40 ft. high and the pool 15 miles long. The primary capacity of the project is 3,600 hp.

At the request of the Louisville Hydro-Electric Company the commission has canceled the preliminary permit issued May 28, 1925, for a development on Green River near Mammoth Cave. Geological conditions were encountered which discouraged the company from further investigations.

Baltimore Rate Reductions

Maryland Commission Orders Cut Meant to Save Electric Customers Million a Year

FURTHER reductions in the electric tariff of the Consolidated Gas, Electric Light & Power Company of Baltimore were ordered last week by the Public Service Commission of Maryland as the result of a protracted inquiry into the rate base of the company. These reductions will become effective on Jan. 1 and supersede the voluntary reductions made by the company in September, 1925, and reported in the ELECTRICAL WORLD for Sept. 26 of that year (page 665). The principal feature of the revision just ordered by the commission is the reduction of the primary rate from 8 cents to 7 cents per kilowatt-hour for a minimum consumption of 25 kw.-hr. a month. The company's reduction last year was embodied in the change of these minimum - consumption figures from 40 kw.-hr., so that the ordinary domestic consumer derived little benefit from the revision, which inured to the profit of industrial users.

The commission figures that the reductions just ordered by it, which, besides the one noted, comprise ten other changes, will save household and other small consumers $650,000 a year, commercial consumers $165,000 and large industrial consumers $140,000—a total of $955,000 in Baltimore city and contiguous territory. Adding reductions ordered for county and rural customers will bring the saving to approximately $1,000,000.

The new rates will be in effect for two and a half years unless sooner modified or abrogated by the commission. The company has the right to appeal to the courts against the order, but, under date of Nov. 12, President Herbert A. Wagner notified the commission that the company would obey it.

High-Pressure Turbine Goes on Line in Milwaukee

A 7,000-kw. turbine operating at 1,200 lb. steam pressure and 720 deg. superheat went into operation at the Lakeside plant of the Milwaukee Electric Railway & Light Company on Saturday, Nov. 6. The steam exhausts from this machine at 317 lb. and is then used in the other turbines in the plant. The B. & W. Stirling type boiler supplying steam to this unit is, for the moment, the largest of its kind. Its nominal rating is 2,853 b.-hp. at 1,390 lb. and it is said to be capable of handling a load of 40,000 kw. Pulverized fuel is burned in the Lopulco type furnace, with a content of 30,100 cu.ft.

This installation is the second high-pressure unit now in use in this country. It is considerably larger than the first, which is in the Edgar plant

of the Edison Electric Illuminating Company of Boston and which has a generator capacity of 3,000 kw. These two installations represent very important advances in the art of steam power, and the economies they effect are of immediate interest to the entire central-station industry.

The throttle of the new machine was opened by Miss Miriam Anderson, the only woman student of mechanical engineering at the University of Wisconsin, whose father, John Anderson, is vice-president of the Milwaukee Electric Railway & Light Company, in charge of power.

Coal in Its Relation to Power

International Conference at Pittsburgh Discusses Supply, Combustion, Low-Temperature Distillation and Many Related Subjects—Four Foreign Nations Represented

ONE thousand persons were registered the first day of the International Conference on Bituminous Coal, held at the Carnegie Institute of Technology, Pittsburgh, Nov. 15 to 18 inclusive. Eleven out of the 41 papers presented were by authors outside the United States, Germany, France, England and Japan being represented by contributors. Several of the papers are of immediate interest in the power-generation field, and others on low-temperature distillation processes give promise of interesting many power producers who are looking for the latest refinements in utilizing coal economically.

Chief among the papers having immediate value in the power field were "Our Coal Supply, Its Quantity, Quality and Distribution," by Marius R. Campbell, United States Geological Survey; "British Research on Fuel Utilization," by Dr. Cecil Lander, director of fuel research, Department of Scientific and Industrial Research, London; "The Practical Value of Fundamental Research on Coal," by A. C. Fieldner, chief chemist United States Bureau of Mines; "Powdered Coal for Power Purposes," by Henry Kreisinger, the International Combustion Engineering Corporation; "Mouth-of-Mine Power Stations," by George A. Orrok, New York Edison Company, and "Relation of Thermal Storage in Boiler and Furnace to Fuel Application," by F. P. Coffin, General Electric Company.

Because of the increasing interest in more economical utilization of coal in power production, the paper on "The McEwen-Runge Process for the Low-Temperature Distillation of Coal," by Dr. Walter Runge, International Combustion Engineering Corporation, is of particular value. This process is being tried on a large scale by the Milwaukee Electric Railway & Light Company at its Lakeside station. The author related McEwen's early work and described the Milwaukee development, explaining the object of the double retorts, heating and gas circulation and calculation of gas values.

Other papers on low-temperature distillation of coal which may or may not find application in the power field were presented by C. V. McIntire, the Consolidated Coal Products Company, New York; F. C. Greene, the Old Ben Coal Corporation, Chicago; Emil Piron and Robert M. Crawford of New York and Pittsburgh respectively; W. A. Darrah, Continental Industrial Engineers, Inc., Chicago; Dr. Fr. Mueller, Essen, Germany; Richard B. Parker, New York, and Clarence B. Wisner, the Carbocite Company, Canton, Ohio. Results of successful attempts to convert coal into oil by means of hydrogenation at high pressures were extensively discussed by Dr. Friedrich Bergius, Heidelberg, Germany.

SOME OF THE POINTS MADE

One point emphasized by Dr. Campbell regarding coal resources of the United States was that out of 3,444 billion tons available at the beginning 16 billion tons had been mined up to December, 1925, and about an equal quantity wasted or made unavailable by mining operations, leaving 3,412 billion tons. Much of this is low-grade coal, however. The present rate of mining is about 600 million tons a year.

Dr. Lander declared that British industrial research is assisted financially the first year by a pound-for-pound grant from the government. Three subjects now being investigated by the government are the most suitable uses for coal, the fusion temperature of ash from different coals and low-temperature carbonization.

Commenting on coal resources, Dr. Samuel A. Taylor, president American Institute of Mining and Metallurgical Engineers, asserted that 28 of the states in the Union produce coal and that Colorado alone could supply the country's needs for a hundred years. Furthermore, Dr. Taylor said, it is now easy to locate coals of any desired characteristics.

Walter Trent described a system of utilizing low-grade coals in powdered form which involves ultra-fine pulverization, mixing with water and then oil to permit separating the ash from the coal-oil amalgam, carbonizing the amalgam and transporting the powder while hot enough to have fluid characteristics.

Henry Kreisinger cited some recent developments in powdered-fuel combustion in water or steam-cooled furnaces which make it possible to increase the combustion rate per cubic foot of furnace volume over 50 per cent. The new 1,200-lb. Milwaukee furnace will have five water-tube front walls, radiant superheater side walls, steam reheater back wall and a water-screen bottom. Another installation will, in effect, be a boiler built around a furnace containing 5,000 cu.ft., with provision for turbulent combustion. It will produce 125,000 lb. of steam (150,000 lb. at peak load) at 300 lb. pressure with a combustion rate of 40,000 B.t.u. per cubic foot per hour. Complete combustion can be maintained at rates as low as 10 B.t.u. or 12,000 B.t.u. per cubit foot per hour.

George A. Orrok referred to certain power plants which have been built at or near mine mouths, but emphasized the point that such sites are feasible only when a market is near and when adequate condensing water and fuel are available. Transmission adds at least 1½ mills to 3 mills per kilowatt-hour to the cost of the delivered energy from 100 to 300 miles away. Cooling-tower stations have never done better than 25,000 B.t.u. per kilowatt-hour, water loss is 10 to 15 per cent and the towers require as much space as the station.

C. H. Berry, discussing the subject for F. R. Low, editor of *Power*, referred to the danger of shutdowns at mine-mouth plants, which might come because of mine operators' or labor decisions. Regarding low-temperature distillation, he asked, "How many are considering delivery of the hot fuel to the furnaces?"

At the second session, presided over by Samuel Insull, president of the Commonwealth Edison Company and a member of the conference advisory board, Mr. Fieldner contended that great progress in industrial research cannot be made without a solid foundation of research in the realm of pure science, illustrating this contention by several examples. He declared that an era of better utilization of coal had opened.

Dr. Thomas Stockham Baker, president of Carnegie Institute, was presiding officer at the opening session. E. M. Herr, president of the Westinghouse Electric & Manufacturing Company and also a member of the conference advisory board, was chairman of the Power Section session. Other members of the conference advisory board included Secretary Andrew W. Mellon, Charles M. Schwab, John Hays Hammond, Otto Kahn, Frank B. Jewett, vice-president American Telephone & Telegraph Company, and George E. Learnard, president International Combustion Engineering Corporation.

Eglin Tells Why His Company Went to Conowingo

In an address before the Poor Richard Club last week, Dr. W. C. L. Eglin, vice-president and chief engineer of the Philadelphia Electric Company, declared that Philadelphia in a few years would have in the Conowingo plant the most adaptable, reliable and economic source of hydro-electric power in the world.

"We, who have studied the important problems of transmitting water power," he said, "have been confronted with three vital questions: First, it is necessary to get a plan that will provide the greatest supply; second, there is the question of reliability for 24 hours of the day for 365 days each year, and in the third place the power must be delivered to the consumer at less cost than any other form. We had to wait until we could absorb all the energy of the Susquehanna before undertaking its full development. Now we can absorb the energy, so it can be developed economically."

Attack State Commissions

Illinois Body an Especial Target at Meeting of National Municipal League in St. Louis

ANOTHER attack on the Illinois Commerce Commission has been made. This one took place at a joint session of the National Municipal League and the Illinois Municipalities Conference on Home Rule for Public Utilities held at St. Louis on Nov. 10. Corporation Counsel F. X. Bush of Chicago, representing the Mayor of that city, called the Illinois regulatory body one "eminently satisfactory to a group of Chicago bankers" and said that state commissions had a task of "utter hopelessness." He pointed to the evidence before the Reed investigating committee involving the late chairman of the Illinois commission in the acceptance of political contributions from utility chiefs and urged home rule for all local utilities, saying:

"Local communities can rout out the wolves who seek benefits from the manipulation of public utilities. In our own Commerce Commission, which works under a system of absentee landlordism, there is every reason why members don't have to figure on the resentment of the communities whose utilities they regulate. It is plain that the municipalities don't like the system, because it has failed, but in spite of the failure there is a tendency toward giving the commission still greater power. The interests supporting it are well organized and are prepared for any effort.

"In theory the commission is supposed to give expert service to municipalities in their problem relating to public utilities," Mr. Bush continued. "In reality, whenever municipalities come before the commission opposing the case of a public utility, no more helpless, one-sided affair could be conceived. The city is usually unable to pay for the gathering of statistics, the hiring of engineers and lawyers, and the case before the commission becomes a hopeless one. Under the law the commission is supposed to initiate reductions in rates. You can count on the fingers of your two hands the number of times this has been done."

Dr. John Bauer, public utility consultant of New York City, who discussed the subject "Has Governmental Regulation of Public Utilities Broken Down?" agreed with some of the declarations of Mr. Bush in his attack on the Illinois Commerce Commission, but observed that interstate regulation and intrastate regulation of needs extending beyond single communities must be retained.

"Public utility regulation has been largely a failure because of the undefined principles and cumbersome methods that have been followed," he declared. "The difficulty of regulation has grown out of the problem of valuation. While the companies are entitled to a fair return, no workable measure of what is fair has ever been definitely laid down by the legislature or approved by the courts." He proposed that rates be based on actual cost, including all elements of cost. This method would base rates on actual "net investment," which, after a single valuation, would be shown by the accounts of the company. All grounds for dispute would be eliminated and rate making would be a simple administrative matter, he said, adding that the commissions would be free to look at various constructive measures for better service and greater economy.

Prof. Martin L. Glaesser of the University of Wisconsin discussed "service-at-cost" franchises for municipal transportation systems and expressed the opinion that such franchises provide a sensible method of redressing the original distribution of power between state commissions and local councils.

New York Metermen Gather at Rochester

A good example was put before the delegates to the annual meeting of the Meter Section of the Empire State Gas and Electric Association, who to the number of 114 gathered at Rochester on Nov. 15 and 16, by President H. M. Brundage of the parent body, who declared his intention of attending every committee meeting during his term of office. Mr. Brundage's speech followed an address of welcome from E. C. Scobell, general auditor of the Rochester Gas & Electric Corporation.

The paper on "What Is a Meter Tester?" by E. E. Hill of the New York Edison Company, scheduled for the Monday morning session, was not presented owing to Mr. Hill's unavoidable absence; but there was an interesting discussion on "Radio Interference and Hunting Radio Trouble," by H. J. Klumb of the Rochester company. Mr. Klumb explained the way in which investigation of radio trouble was made by his company, asserting that a careful, organized procedure by the use of questionnaires and personal calls on complainants must be followed if the best results are to be attained. The responsibility of investigation rested largely with the line crew and repair department, which should co-operate closely with the test department.

The papers of Monday afternoon and Tuesday were technical in nature and were nearly all illustrated by lantern slides. These papers included "The Evolution of the Induction Watt-Hour Meter," by G. A. Sawin, Westinghouse Electric & Manufacturing Company; "Meter Testing on Customer's Premises," by E. A. LeFever, Buffalo General Electric Company; "Quick and Accurate Method of Meter Testing," by H. N. Porter, the States Company, and "Use of Test Meters and Instruments," by H. G. Hamann, General Electric Company. The final paper, "European Electric Meter Practice," by Herbert Nehls of Landis & Gyr, outlined in some detail the systems employed in Continental countries, but indicated that American companies had little to learn from them in this regard.

W. J. Consler, Rochester Gas & Electric Corporation, was elected chairman of the section, and G. B. Teevan of the Brooklyn Edison Company vice-chairman. Fifteen manufacturers exhibited equipment. The dinner Monday evening and the inspection trips were well attended.

Utility Heads Are Accused

Indianapolis Merger Opposed Because of Alleged Corrupt Influence Over Personnel of Commission

ALLEGATIONS of corrupt political bargaining affecting the Indiana election of 1924, in which various utility company chiefs are made to play the part of contributing to campaign funds to bring about the retention or appointment of public service commissioners acceptable to them, are contained in an application made on Monday in the Circuit Court at Indianapolis for an injunction to prevent the Indiana Public Service Commission from hearing on Thursday the application made to it for the merger of the Merchants' Heat & Light Company and the Indianapolis Light & Heat Company, hitherto competing concerns in the state capital. When the court hearing was held on Wednesday there was a failure to produce evidence in support of the charges, and the judge refused to grant the temporary injunction, but set Dec. 1 as a tentative date for a hearing on the question of granting a permanent injunction. Evidence to show that utility operators conspired to obtain favors through campaign contributions might be introduced at that time, the court said.

These accusations are made by Corporation Counsel Alva J. Rucker of Indianapolis, and the utility heads named are Samuel Insull and his brother, Martin J. Insull; Harley L. Clarke of Chicago and Harry Reid and Robert I. Todd of Indianapolis. The Insulls and Clarke have been competitors for control of the light and power business in Indianapolis, the Insulls having in 1924 added the Merchants' Heat & Light Company to the utilities under their control and having more recently acquired a minority interest in the Indianapolis Light & Heat. By the terms of the merger the Clarke holding company, which now controls the Indianapolis Light & Heat, would possess the entire local field. Mr. Reid is president of the Interstate Public Service Company, an Insull property, and Mr. Todd is president of the Terre Haute, Indianapolis & Eastern Traction Company, with similar affiliations.

The specific sum of $19,000, the complaint alleges, was paid to Governor Ed Jackson of Indiana and John W. McCardle, chairman of the Public Service Commission, during the campaign of 1924 to retain McCardle as a member of the commission and to insure the appointment of Clyde H. Jones as another commissioner. Samuel R. Artman, also a commissioner, entered the conspiracy, the complaint alleges, to obtain the support of the utility companies in his campaign for a judgeship of the State Supreme Court.

The charge is made that Jackson during his candidacy for Governor agreed that if he were elected he would appoint and retain on the commission "only individuals who would be unduly and illegally favorable" to representatives of the utilities. Commission members named as "a majority faction" favorable to the utility interests are McCardle, Jones and Artman. McCardle was reappointed by Governor Jackson

after his election. Jones also was appointed by him.

Martin J. Insull has issued a flat denial of the charges. "I know nothing about the local political situation and have never taken any interest in it and have no knowledge with regard to the $19,000 being paid to any one," he said. "Any statement that money was paid to any one for any illegal purposes is absolutely untrue." Counsel for the commission pressed for a speedy hearing.

St. Lawrence License Seems Unlikely

New York Water Power Commission Meets but Takes No Action, Adjourning Without Date—Chairman Will Probably Follow Governor Smith's Lead

THERE is little likelihood that the New York State Water Power Commission will grant a lease of power on the St. Lawrence River either to the St. Lawrence Valley Power Corporation or the American Super-Power Corporation, both of which are now seeking licenses. At an informal meeting of this body held in Albany on Wednesday, with the chairman absent, a long discussion was followed by no action. The commission set no date for a further hearing, and it is believed that it will go out of existence on Dec. 31 without granting a license.

It is reported from Albany that Governor Smith will on Jan. 1 reappoint Alexander Macdonald, a Republican, as head of the Conservation Department of New York State, an appointment which will then as now carry with it the chairmanship of the Water Power Commission. The belief is that Mr. Macdonald is opposed to granting an immediate license to either of the applicants for St. Lawrence River hydro-electric rights. After Jan. 1 the Governor will have a veto power over the action of the commission under the reorganization of state departments which then goes into effect. The new board, one of three members only, will contain, besides the head of the Conservation Department, Attorney General Ottinger, the only candidate on the Republican state ticket to be reelected, and the Commissioner of Public Works—now Colonel Frederick S. Greene, a Democrat, who is likely to be reappointed by the Governor. An effort to bring about co-operation on the water-power problem between the two political parties that divide control of the state government will probably be made under the Governor's lead.

An ingenious argument of the wire-drawn variety is being made at Albany to the effect that the Governor will not, after all, under the new state department law, possess a power of veto over licenses granted by the Water Power Commission. The clause designed to give him this power reads:

"Notwithstanding the provisions of Article 10-a of the conservation law, a license under the provisions of such article issued by the Water Power and Control Commission shall not be effective unless and until it is approved in writing by the Governor and such approval is signed by him and affixed thereto. A modification of such license shall not be effective until approved by the Governor in like manner."

The contention is that this clause confers upon the Governor a mandatory, not a permissive exercise of power. That is, that he will be compelled to approve the acts of the commission because to refuse to do so would vest him with powers not included among those bestowed upon him by the constitution. Since no less eminent a constitutional lawyer than Charles E. Hughes was chairman of the body that drew up the new state department law, it seems hardly likely that the Governor's veto can be thus upset.

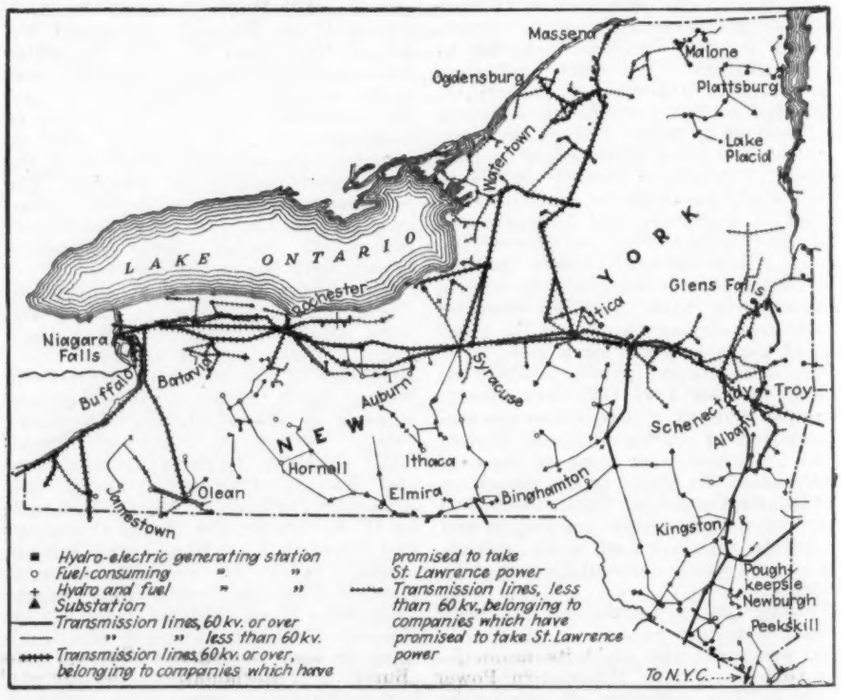
Empire State Association Takes Hand in Debate

Over three million continuous horsepower is running to waste each year in the rivers of New York State, according to the Empire State Gas and Electric Association. In a pamphlet just issued, entitled "Water Power in New York State—What Its Development Will Mean for the Public," the association discusses the economic considerations which make prodmpt utilization of these wasted resources desirable.

This pamphlet says: "The electrical industry, which has already put to work 1,750,000 hp. of water power in serving the people of New York, stands ready to harness this unused water power. Some of it, where no legal obstacles prevent, is being developed now. Development of the bulk of it, however, must await authorization by various official bodies and governments. If and when such authorization can be obtained, the electrical industry is prepared to undertake the engineering and financing tasks, of unequaled size and difficulty, involved in the projects. It has the plans. It has the men who can carry them to success. It can get the money, and before it gets back one cent in revenue it will be required to spend hundreds of millions of dollars on some of the developments."

On the international section of the St. Lawrence, according to the pamphlet, 2,400,000 hp. could be developed, half of which would come to New York State; while at Niagara 1,000,000 additional horsepower could be produced without detriment to scenic beauty, and from interior rivers also 1,000,000 additional horsepower could be developed. This great aggregate of power, it maintains, represents only projects carefully studied which the electrical utilities are willing to undertake.

Interconnection in New York and St. Lawrence Power



THE map here printed is a simplified reproduction of one filed with the New York State Water Power Commission by the Frontier Corporation to show the interconnected transmission system that covers a large part of New York State. Lines of the central-station companies which have promised the Frontier Corporation to buy energy generated by power from the St. Lawrence River are distinctively indicated.

The companies included are the Buffalo, Niagara & Eastern Power Corporation, the Mohawk-Hudson Power Corporation, the Northern New York Utilities, Inc., the Oswego River Power Corporation, the Rochester Gas & Electric Corporation and the St. Lawrence County Utilities, Inc.

Purchases and Mergers

McGraw Electric and Central West Public Service Companies Consolidate—Serve Five States

BY THE consolidation of the McGraw Electric Company and the Central West Public Service Company, announced on Monday of this week, public utility properties in Iowa, Nebraska, Minnesota and the Dakotas with a total capitalization of about $10,000,000 are affected. Formation of the Central West Public Service Company was reported in the ELECTRICAL WORLD for July 17 (page 135), with a list of towns served. The McGraw company controls the Platte Valley Power & Light Company of Omaha and its subsidiaries and serves Bennington, Elkhorn, Jackson and other small Nebraska communities. A number of independent public utilities will also be acquired, and the entire group of properties will hereafter be owned and operated by the Central West Public Service Company. Max McGraw will continue as president of the McGraw Electric Company and W. N. Albertson of Milwaukee will continue as president of the Central West Public Service Company.

The General Gas & Electric Corporation has announced the purchase of the Blue Mountain Electric Company. The Blue Mountain company serves power to Berks and Lebanon Counties, Pennsylvania. It now becomes a part of the Metropolitan Edison Company of Reading, Pa., the largest subsidiary of General Gas & Electric, and will be included in the latter's Pennsylvania-New Jersey power system.

Henry L. Doherty & Company of New York have purchased the Bluff City (Tenn.) Electric Light & Power Company. The consideration was not made public. Bluff City is 11 miles from Bristol, where the Bristol Gas & Electric Company is Doherty-owned.

The town of Manassas, Va., is negotiating with the Virginia Public Service Corporation for the sale of the municipal lighting plant at the price of $70,000.

Certificates have been filed in the office of the Secretary of State of New York merging the Roxbury Light & Power Company, Earlville Electric Light Company, Livingston Manor Electric Company, Seely Electric Company of Spencer and Smyrna Electric Company with the Moravia Electric Light, Heat & Power Company. These are all Associated Gas & Electric Company properties.

Purchase of the Anchor (Ill.) Electric Light Company by the Central Illinois Public Service Company has been authorized by the Illinois Commerce Commission.

Leola, S. D., has sold its municipal lighting plant to the Northern Power & Light Company, which has also bought the Blunt (S. D.) Light & Power Company. The Belview (Minn.) Electric Light & Power Company has sold its plant and distribution lines to the Northern States Power Company. The Water, Light & Power Company of Hot Springs, S. D., has been purchased by the McGraw Electric Company. The Montana-Dakota Power Company has purchased the Medicine Lake (Mont.) Electric Utilities Company. This company now serves twelve towns in Montana.

Arthur Williams Gives Figures for Farm Electrification

In an address delivered on Nov. 17 before the annual meeting of the Academy of Political Science at New York, Arthur Williams, vice-president New York Edison Company, discussed "Power on the Farm." He estimated "the cost of joining the power plants and the farms of the country by 'electrical highways' " at six billion dollars, the cost of equipment for the farmers' use at four and three-quarters billions and the provision of adequate power at enough more to bring the total cost of the three items to fifteen billions. The second item, Mr. Williams said, the farmers themselves should take care of, perhaps by means of installment payments; to the third item he felt convinced the utility companies will prove adequate when the demand arises; the first item, electrification of the highways, was, in his opinion, the most formidable. Here some form of collective assistance seems necessary.

Among suggestions as to the ways in which this could be extended, Mr. Williams mentioned tax-exempt securities, confined to the erection of rural transmission and distributing lines, issued under such competent authority as the public service commissions of the states; the omission of federal and local taxes on rural service for prescribed areas, and payment of interest on rural-line securities by farm organizations or the local authorities, the funds for retirement being perhaps provided by the utility companies rendering the service. Mr. Williams expressed confidence in the solution of the problem, which he declared to be of paramount importance, not only in the civic but in the economic life of the nation.

Backs Hoover Policy on Water Resources

American Engineering Council Indorses Secretary's National Plan—Adopts Scheme for Federal Department of Public Works and Domain—Opposes Redundant Data

INDORSEMENT of the plans of Secretary Hoover for a national policy in the development of water resources, as outlined in his recent Seattle speech, was extended by the American Engineering Council when it met at Cornell University, Ithaca, N. Y., on Nov. 11 and 12, the council adopting a resolution to that effect offered by A. W. Berresford, chairman of its public affairs committee.

"Secretary Hoover," an announcement sponsored by the council says, "has well pointed out the growing interstate friction, local litigation, political obstruction, and even international complication, over water questions which are being evinced throughout the country. Although in almost every case this could be cured by the provision of more water supplies through storage or regulatory engineering works of some kind, only co-ordinated plans and organization can bring about this desired construction."

The council made public a report from a committee which has for two years been studying federal departmental reorganization. E. O. Griffenhagen of Chicago is chairman of this committee, whose report, President Dexter S. Kimball of the council said, is the most scientific and exhaustive study ever made in this field. It advocates the establishment of a Department of Public Works and Domain, in which it is proposed to group the Geological Survey, the Bureau of Reclamation, the General Land Office and other boards now in the Department of the Interior; the Bureau of Public Roads and Forest Service, now in the Department of Agriculture, and various agencies now in the War or Treasury Department or existing as independent instrumentalities, including the Federal Power Commission as well as War Department bureaus controlling rivers and harbors.

The council also took action to check the flood of demands for data from corporations made by federal and state governments, voting to co-operate with the National Association of Manufacturers and other bodies in devising a plan to minimize the volume of corporate reports, which, it is charged, impose on industry useless burdens costing millions of dollars annually.

The annual meeting of the council will he held in Washington on Jan. 12 to 15.

New Broadcasting Company Sets Rapid Pace

With an audience estimated at between five and ten millions and through a combination of 24 broadcasting stations extending from the Atlantic Ocean to far beyond the Mississippi River, the National Broadcasting Company put on its first entertainment last Monday night. It embraced world-famous singers, orchestras and entertainers, Mary Garden at Chicago, and Will Rogers at Independence, Kan., being among the number.

M. H. Aylesworth, president of the new company and former managing director of the National Electric Light Association, announced the formation of an advisory council of prominent citizens to determine wise use of the extensive facilities. James G. Harbord, president Radio Corporation of America; Guy E. Tripp and Owen D. Young are members.

The National Broadcasting Company owns station WEAF, manages stations WJZ in New York and WRC in Washington and will supply programs at present to two networks of associated stations throughout the country, one chain headed by WEAF and the other by WJZ. The chains will be extended and will be hooked into one system on special occasions. The company also will co-operate in perfecting the technical phase of national broadcasting.

Virginia's Water Power

New River Development Will Begin in 1927—Projected Roanoke Plant—Hydro Output Grows Fast

VIRGINIA'S water-power development during 1927 will at least equal and in all probability much excel all previous power development within the state, according to a survey which has been made by the Virginia State Chamber of Commerce. Several large power development projects also are being discussed by large companies in Virginia and every indication points to the rapid development of much of the dormant power of the state.

Probably the largest project to get under way in the coming year will be the one sponsored by the Appalachian Electric Power Company near Pulaski. This company has acquired title to about 10,000 acres of land on the New River and made application to the Federal Power Commission for a license to erect a dam and hydro-electric plant. The dam would flood more than 6,500 acres of the property purchased by the company and create a lake 20 miles long with a width of about a mile and a half and with a shore line 95 miles around. It is estimated that the plant, which would have an operating head of from 100 ft. to 110 ft., would develop about 85,000 kw.

Reports emanating from Danville, where there are many textile mills, say that the same company has bought an extensive acreage of property on the Roanoke River for another power development, the size of which cannot be estimated. At the beginning of the year the Appalachian Electric Power Company served more than 400,000 persons, with a total power production of 113,400 kw. The New River development alone will almost double its production.

The Virginia Electric & Power Company, operated by Stone & Webster, plans the expenditure on power development in Virginia of a very large sum during the next few years. Besides the coming five-million-dollar steam plant at Norfolk, recently announced, a small plant has been installed at Tappahannock, and the company is completing a high-tension line which will reach almost the entire length of Virginia and will connect the important hydro-electric development at Roanoke Rapids with the hydro-electric plant and holdings of the corporation at Fredericksburg. High-tension transmission lines also connect Richmond with Norfolk, and the lack of a unified and connected power development pointed out by the Virginia State Chamber of Commerce more than two years ago, when its power development program was adopted, is ceasing to exist.

In the autumn of 1925 the Virginia State Chamber of Commerce found that more than 80 power companies were operating in the state. At present there are barely half that many, and many of these are small community companies either buying their power from the large companies or with small oil or steam plants rarely developing more than 2,000 kw. Federal Power Commission figures show Virginia's potential water-power development to be about 1,000,000 hp., of which a year ago only 110,000 hp. had been developed. With small projects which are being developed now and with developments announced, the beginning of 1927 will see at least one-fourth of the possible development of Virginia water-power on the way to become a reality.

Regional Meeting of A.I.E.E. Held in New York

A program of timely interest was presented at the regional meeting of the American Institute of Electrical Engineers held at the Engineering Societies Building, New York, on Nov. 11 and 12. Besides the three technical sessions, there were a public lecture of general interest on Thursday evening, "On the Frontier of Science," by Robert W. Wood, professor of experimental physics at Johns Hopkins University; a demonstration of the electrodeless induction lamp on Friday morning in connection with the paper referred to below, a demonstration of the vitaphone by E. B. Craft, executive vice-president Bell Telephone Laboratories, and inspection trips to the Edison Lamp Works at Harrison, N. J.; the Electrical Testing Laboratories, the Hudson Avenue (Brooklyn) and Kearny (N. J.) generating stations and other plants.

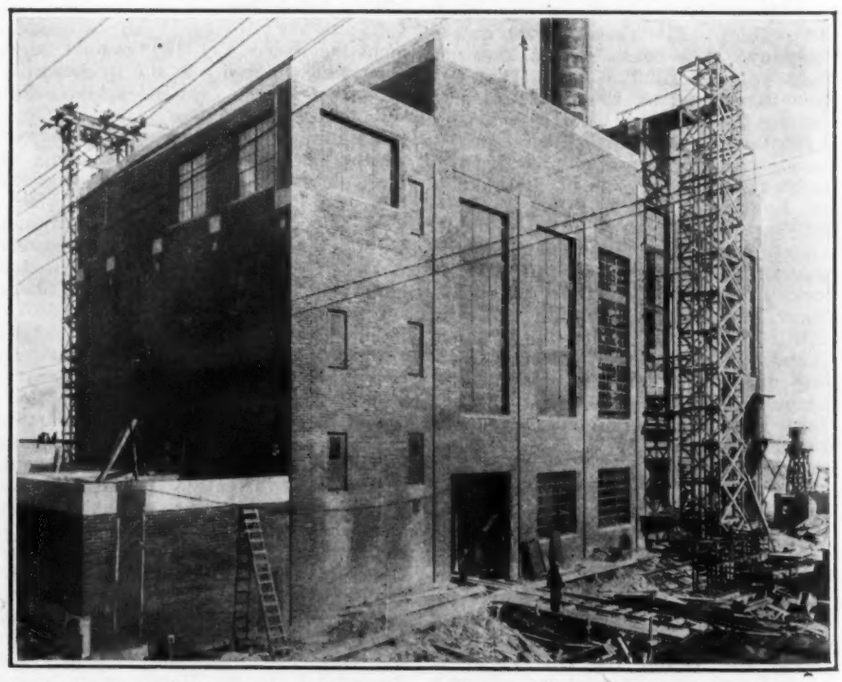
Thursday morning's meeting was a "distribution session." J. F. Fairman and R. C. Rifenburg of the Brooklyn Edison Company described "Recent Progress in Distribution Practice"; G. G. Grissinger, Westinghouse Electric & Manufacturing Company, gave a paper on "Automatic Alternating-Current Network Switching Units"; J. S. Parsons (Westinghouse) one on "Evolution of the Automatic Network Relay"; W. R. Bullard, Electric Bond & Share Company, one on "Operating Requirements of the Automatic Network Relay," and D. K. Blake, General Electric Company, told of "Alternating-Current Network Relay Characteristics."

At an illumination session on Friday morning, held jointly with the New York Section of the Illuminating Engineering Society, W. S. Dempsey, New York Edison Company, discussed "Remote Control of Multiple Street-Lighting Systems"; G. T. Johnson, New York, New Haven & Hartford Railroad, "Lighting of Railway Classification Yards," while T. E. Foulke, Cooper Hewitt Electric Company, described "The Induction Lamp, a New Source of Visible and Ultra-Violet Radiation," Saul Dushman (General Electric) contributing theoretical considerations concerning illumination from atoms.

Three papers were presented at Friday afternoon's communication session —"Frequency Measurements with the Cathode-Ray Oscillograph," by F. J. Rasmussen; "A Shielded Bridge for Inductive-Impedance Measurements," by W. J. Shackleton, and "Radio Broadcast Coverage of City Areas," by Lloyd Espenschied.

Abstracts of some of the technical papers will be given in coming issues in the "Digest of Electrical Literature."

First Unit of Green Bay's Steam Plant Almost Ready



CONSTRUCTION of the Wisconsin Public Service Corporation's new two-million-dollar Bayside steam plant at Green Bay, which will rank with the larger steam plants in Wisconsin, has progressed to a point allowing the installation of equipment. It is expected that this plant, which will have a rating of approximately 22,500 kw., will be in full operation early next year, and the installation of one turbo-generator of 10,000 kw. capacity is looked for as early as Dec. 1. This new plant will be tied in with the company's other steam and hydro-electric plants, bringing their total rating above the 100,000-hp. mark.

New Tallulah and Tugalo Plants Almost Ready

The two new developments of the Georgia Railway & Power Company on the Tallulah and Tugalo Rivers—the Nacoochee dam and power house and the Lake Burton power house—will, it is expected, both be put in operation shortly. Material for the construction of the Nacoochee dam and power house had to be carried to the scene of operations by a specially organized company merchant marine. The topography of the country prohibited the construction of a railroad such as is generally used, so boats and barges were built on the short of Lake Rabun which, either driven by their own gasoline motors or towed by gasoline launches, transported thousands of tons of building material to the scene of the development.

The dam and power house at Nacoochee are 1,750 ft. above sea level. The dam is 500 ft. across and 60 ft. high. The lake that will be formed will cover 250 acres and will impound 110,000,000 cu.ft. of water. The power developed will total 9,000 hp.

The Burton dam has been completed some time, but the power house has not yet been opened. The dam is 116 ft. high and 1,250 ft. long and backs up a lake covering 2,775 acres, into which water drained from an area of 136 square miles of territory flows. This power plant is rated at 12,000 hp. Completion of the two projects will give the Georgia Railway & Power Company six hydro-electric power plants on the Tallulah and Tugalo River systems.

Briefer News

Interstate Power Company to Build New 66,000-Volt Line in Nebraska.—The Interstate Power Company has started work on a 66,000-volt line to run from Wynot, Neb., to Hartington, Coleridge, Creighton and O'Neill. The new line, which will be 90 miles long, will serve about 50 towns in northern Nebraska.

Florida Public Service Company Forges Ahead.—R. A. Jones, vice-president of the Florida Public Service Company, whose headquarters are at Orlando, announces that the directors of the company have appropriated $3,600,000 for extension of its electric and gas utility properties in 1927. This year this company has invested $5,000,000 in Florida properties, Mr. Jones says, a sum which far exceeded the budget.

Springfield (Mass.) Company Abandons Removal Plans.—The United Electric Light Company, Springfield, Mass., has reached an agreement with the New York, New Haven & Hartford Railroad and the park commissioners of the city of Springfield whereby it will receive enough additional land to provide for tentative expansions. Additional property has been a vital point in the affairs of the electric light company, so much so that steps had been taken for the removal of the plant to West Springfield. With the addition of more land adjoining its present plant the United Electric Light Company has abandoned all plans for transferring its plant across the river.

Ducks Plunge City Into Darkness.—Elkhart, Ind., which is supplied with energy by the Indiana & Michigan Electric Company, was plunged into darkness for half an hour on a recent evening when two wild ducks flew simultaneously against the high-tension wires and short-circuited them. Street cars stood still and motion pictures stopped. It was declared the longest complete interruption of service in Elkhart in more than twenty years.

Coming Meetings of Electrical and Allied Societies

[A complete directory of electrical associations, with their secretaries, is published in the first issue of each volume. For latest list see ELECTRICAL WORLD, July 3, page 50.]

American Society of Agricultural Engineers, Farm Power and Machinery Division—Chicago, Dec. 1 and 2. Raymond Olney, St. Joseph, Mich.

Pacific Coast Electrical Association—San Francisco, Dec. 2-3. S. H. Taylor, 447 Sutter St., San Francisco.

American Society of Mechanical Engineers—New York, Dec. 6-9. C. W. Rice, 29 West 39th St., New York.

National Electrical Credit Association—New York Division, Hotel Commodore, New York, Dec. 14; New England Division, Boston, Jan. 18. F. P. Vose, 1008 Marquette Bldg., Chicago.

Northwest Association of Electrical Inspectors—Multnomah Hotel, Portland, Ore., Jan. 17 and 18. F. D. Weber, Box 745, Portland.

National Electrical Manufacturers' Association (Supply Division)—New York, Jan. 17-21. F. Nicholas, 30 East 42d St., New York.

Western Association of Electrical Inspectors—Kansas City, Mo., Jan. 25-27. W. S. Boyd, 175 West Jackson Blvd., Chicago.

American Institute of Electrical Engineers—Midwinter convention, New York, Feb. 7-10; Southwestern District, Kansas City, March 17-18. F. L. Hutchinson, 36 West 39th St., New York.

Large New Municipal Power Station Opened in England.—By the inauguration at a cost of £300,000 of a new electric power station, the old city of Norwich, one of the most progressive in the United Kingdom, becomes the controller of a large municipal undertaking which is expected to be profitable. There are now 16,000 consumers, more than half the houses in the city being connected, and the total area supplied will be about 400 square miles, including six neighboring towns. There are two 5,000-kw. turbo-generators, and another of the same type will be moved soon from the old station to the new, still leaving room for a fourth.

Seattle Plans for 1933.—In pursuance of its ambitious hydro-electric plans, the city of Seattle has placed application with the State Hydraulics Office for the appropriation of an additional 3,300 sec.-ft. of water from the Skagit River and all of its tributaries eastward from Ruby Canyon. The power house will be approximately 125 miles from Seattle, and it will mean an added output of 140,000 hp. when the plant is placed in operation, which may be in 1933. A 500-ft. fall will be utilized. To impound the 3,800,000 acre-ft. of water to be stored in the Ruby Canyon reservoir a concrete-arch dam 235 ft. long and equipped with steel headgates will be constructed, causing submergence of 17,000 acres. The dam and reservoir equipment alone will require one-third of the estimated ultimate outlay of $24,000,000.

Commission Defers Decision on Electric Rates at Elmira, N. Y.—The New York Public Service Commission has deferred its decision on the light and power rates of the Elmira Water, Light & Railroad Company, complained of by the city as too high, until a study of optional rates filed by the company can be made. It finds, however, that average residential consumers are being supplied with electricity cheaper than anywhere else in the state outside the Niagara district.

Progress on St. Louis' New Street-Lighting System.—The first section of the eight-million-dollar street-lighting system which St. Louis is installing will be in service almost immediately, according to Superintendent G. B. Heath. Bonds to finance the construction were voted in 1923. The first district includes the territory between Chouteau Avenue and Arsenal Street, Compton Avenue and the Mississippi River. There are 3,918 lamps in this district. A second district including the territory between Chouteau Avenue, Cass Avenue, Jefferson Avenue and Grand Boulevard, with 1,977 standards, will be completed within three weeks. In a third district there are to be 3,446 lamps.

East Oklahoma Light and Power Men to Meet at Tulsa Next Week.—Planting of trees will be one of the subjects discussed at the Eastern District conference of the Oklahoma Utilities Association, Electric Light and Power Division, to be held at Tulsa Nov. 26. Rural electrification will be considered, and the reports of progress in this work will doubtless allude to the inauguration on Nov. 4 of service over the Oklahoma Gas & Electric Company's Paul's Valley line—the first farm extension line in the state.

Ten-Year Lease of Municipal Plant Proposed.—Confronted with the three-cornered problem of retaining control of its electric system, lowering its electric rates and raising $28,000 for additions and improvements to its distribution and street-lighting systems, the City Council of Rice Lake, Wis., is considering a proposal from the Northern States Power Company to lease and operate the system for ten years at an annual rental equivalent to the 1925 profit of the city's electric department, or $10,894, the company to make the needed additions and improvements, lower the rates and spend $15,000 additional for maintenance.

Great Britain Borrows an Electrical Idea from America.—The British Electrical Development Association, in conjunction with the Electric Lamp Manufacturers' Association of England, has been conducting an energetic campaign

in Great Britain patterned after the home-lighting campaign which was so successful in this country in 1924. Members of the above associations who had visited the United States about that time thought so well of the plan and the result produced that they followed it almost step by step, changing only the terminology and some other minor details to suit local conditions.

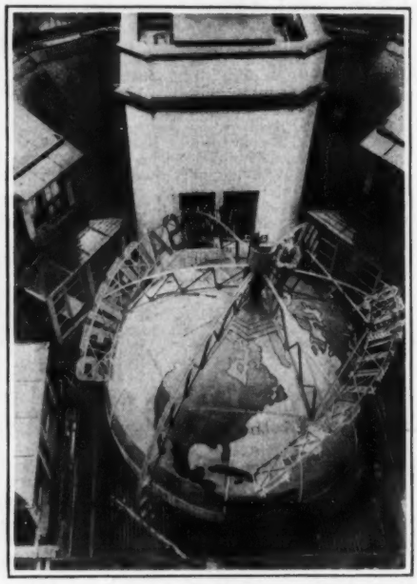
International Engineering Conference Planned for Japan.—The major engineering societies of the United States, Secretary of Commerce Hoover and others interested have indorsed the project initiated by Japanese engineers of holding a world's congress of engineers in Japan in 1929. Prof. M. Kamo, president of the Japanese Society of Mechanical Engineers, who was recently entertained at luncheon at the Engineers' Club in New York, is in charge of the movement in his native country and reports that the government of that nation is supporting it.

Meetings of Electrical Credit Association.—The New York Division of the National Electrical Credit Association will hold its annual meeting at the Hotel Commodore, New York, on Tuesday afternoon, Dec. 14, with a supper in the evening. The New England Division will meet in Boston on Jan. 18. These meetings follow those of the Middle and Southern Atlantic States Division, held in Philadelphia on Nov. 12, and the Central Division, held in Chicago on Nov. 18 and 19. The program carried out by the Philadelphia meeting was printed in these columns on Nov. 6 (page 983).

Iowa Municipal Plant Turns for Service to Central-Station Company.—The City Council of Marshalltown, Iowa, has contracted with the Iowa Railway & Light Corporation of Cedar Rapids to furnish energy for its street-lighting system, which the city owns, and for the water department. The city has been generating its own energy for these purposes for many years. The city has also availed itself of the more advantageous buying power of the private corporation by turning over to it the problem of replacements and maintenance of the street-lighting system. The contract is for five years.

State Line and General Electric Companies Sign Contract for 208,000-Kw. Unit.—Contract between the State Line Generating Company and the General Electric Company for the first unit of the great new station on Lake Michigan, on the Indiana side of the Illinois-Indiana boundary, were signed on Nov. 11. As already reported in the ELECTRICAL WORLD, this unit, which will generate 208,000 kw. at 18,000 volts, will be a triple machine, combining one 76,000-kw. generator on the high-pressure side with two 66,000-kw. elements on the low-pressure side. The energy produced will be wholesaled by the State Line company to its owning companies—the Commonwealth Edison, the Public Service of Northern Illinois, the Northern Indiana Public Service and the Interstate Public Service. It is expected that the unit just ordered will go into service in 1929. It will be followed by four others as required—none of them to be of less than 200,000 kw.—until the station reaches its planned capacity of about 1,000,000 kw. This is almost as much as the combined generating capacity in the Chicago-Illinois-Indiana industrial area at the present time.

"Illuminated World" Pleases Parisians.—An original piece of illuminated advertising is being displayed in Paris, to the admiration of the passing crowds, by a large shipping firm, Les Messageries Maritimes. It is spherical in shape, representing a miniature world, electrically lighted, with the continents outlined on its sides. It is nightly hoisted to the top of a Paris



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office building, where a miniature ship, also lighted with tiny electric bulbs, "tours the world." The photograph shows the globe at rest.

Political Tale of Cut in Ontario Hydro Rates Not Confirmed.—Replying recently to a statement by a candidate at a political meeting in Ottawa, Ontario, that the cost of Hydro power in Ontario would be reduced 50 per cent in the near future, Premier Ferguson said: "That information may have come from the Hydro commission, but not from me. What I have said is that we were negotiating contracts which would enable us to give power to eastern Ontario on a basis and at a price comparable to that quoted in western Ontario, so that the cost of manufacturing in eastern Ontario, as far as power is concerned, would be no higher than the cost in the western portion of the province."

Beatrice, Neb., Still Vacillates. — Threatened not only with a permanent injunction but with a referendum election, the City Council of Beatrice, Neb., has repealed the ordinance providing for the issuance of $920,000 of revenue bonds, and enacted one calling for $251,000 bonds. The larger sum was to enable the city to take over the water power and electric plants of the Gage County Electric Company, which supplies energy to the city as a wholesaler, and the transmission lines and distribution system within the municipality of the Nebraska Gas & Electric Company. In the new plan only the latter property is to be acquired, the other company continuing in the rôle of wholesaler. The legality of the ordinance is to be tested. A special election has been called on the proposal for Dec. 21.

Raising Wall of P. G. & E. Reservoir Doubles Its Storage Capacity. — The greater dam on Lake Fordyce, one of the Pacific Gas & Electric Company's string of storage reservoirs far up in the Sierra Nevada Mountains, has been completed, and, with its rock wall 47 ft. higher than before, awaits the coming of the winter floods. This achievement completes the conservation of the waters of the South Yuba River, will add to the output of four hydro-electric power plants and will provide the farmers of a large territory with more water for irrigation. The dam has been raised three times since it was built in the early seventies. It now stores 46,700 acre-ft., is 116 ft. high and has a crest nearly a fifth of a mile long. At base the rock fill has a width of 300 ft., and it tapers upward at the natural angle to 10 ft. at the top.

Linemen Strike in Metropolitan Territory. — Three hundred linemen and other outside workmen of the Westchester Lighting Company, the Northern Westchester Lighting Company and the Yonkers Light & Power Company, all of which belong to the metropolitan group of light and power companies of which the New York Edison Company is the chief, went on strike on Nov. 10 over questions connected with the laying off of emergency employees and the organization of a union. Plants at Yonkers, Mount Vernon, Port Chester and White Plains were affected, but the power-house men stayed in and there was no interruption of service. No violence is anticipated, but the sheriff, as a precautionary measure, stationed armed deputies at the power plants.

Electrification of Canadian Pacific in British Columbia Under Consideration. —According to a Vancouver (B. C.) dispatch, the Canadian Pacific Railway is planning to electrify the Pacific Coast end of its line and will look to the British Columbia Electric Railway Company to supply the power. For this reason the latter company will, the dispatch says, begin work this winter on its projected twelve-million-dollar hydro-electric plant at Bridge River, with the expectation of developing 50,000 hp. in two years and then doubling that amount. The company's program in this connection involves the expenditure of $38,000,000 in the next five years. The British Columbia provincial government is reported to have under consideration the electrification of the Pacific Great Eastern Railway, which passes within a short distance of the Bridge River power project.

Men of the Industry

H. H. Henline Receives A.I.E.E. Appointment

Prof. Henry H. Henline of Stanford University, California, has been appointed assistant national secretary of the American Institute of Electrical Engineers and will join the headquarters staff of the Institute in New York about Jan. 1. Mr. Henline has for many years been deeply interested in the Institute and is well equipped by training and experience, including personal participation in Institute activities, for his new work. He was elected to membership in 1919, has presented several papers at Institute conventions, was elected chairman of the San Francisco Section in 1922, is at present counselor of the Institute branch at Stanford University, and at the recent Pacific Coast convention in Salt Lake City was elected, by his associate counselors in the Pacific district, chairman of the committee on student activities for that district.

Professor Henline was born in Colfax, Ill., March 12, 1889, and was graduated from the University of Illinois in the electrical engineering course in 1914. After three years' experience in Chicago, he became an instructor at Stanford University in 1917 and was later promoted to his present position of associate professor of electrical engineering.

Irving W. Phillips, formerly connected with Perry & Whipple, Providence, R. I., is now affiliated with Gray's Electrical Engineering & Construction Company, also of that city, which engages in the construction of power and light installations, specializing in power plants and large industrial work.

P. L. Smith, who has been connected with the North American Light & Power Company, Chicago, since 1916, is now treasurer of that organization. At first Mr. Smith was assigned to the financial and accounting department. For three years he served as assistant secretary and assistant treasurer of all the companies in the North American Light & Power group.

Charles A. Chase has been appointed industrial manager of the New England division of the General Electric Company, Boston. Mr. Chase succeeds George F. Steele, who retires from the company after 41 years' service during which he was intimately connected with many prominent industrial electrical developments in that district.

O. E. Sinclair, who since June, 1925, has been engineer of electrical distribution construction, attached to the general office of the Public Service Company of Northern Illinois in Chicago, has been appointed district manager at Lacon, to succeed Ray Carr, who has been transferred to Pontiac. Like his predecessor in the Lacon office, Mr. Sinclair entered the company's employ as a troubleman. He served in this and similar capacities until 1917, when he entered the army. Soon after his return in 1919 Mr. Sinclair was made district engineer at Crystal Lake, after which he served as chief clerk and then was transferred to the general offices, becoming valuation engineer prior to his appointment as engineer of electrical distribution construction. Mr. Sinclair was graduated from the University of Illinois as an electrical engineer.

W. E. Taylor has been promoted to the managership of the Charles City district of the Central Iowa Light & Power Company to succeed Everett E. Baxter, who has been promoted to the office of vice-president. Mr. Taylor entered the employ of the company twenty years ago in Waterloo, where he worked for fifteen years, subsequently being transferred to Kewanee, Ill., and more recently to Charles City as sales manager of that district.

Henry I. Harriman, president of the New England Power Association, Boston, has made a gift to Wesleyan University, Middletown, Conn., covering the cost of immediately constructing a new 100-room dormitory in memory of his father, Daniel Gould Harriman, of the class of 1864. Mr. Harriman has been a trustee of Wesleyan since 1912 and is the twenty-first member of his family to receive a degree from this institution.

L. C. Haskell has been appointed secretary of the Power Corporation of Canada to succeed K. S. Barnes, resigned, according to an announcement made by A. J. Nesbitt, president. **C. Johnstone** has been appointed treasurer. Mr. Nesbitt also announced that Mr. Haskell has been elected a director and secretary of the following companies, to succeed K. S. Barnes: East Kootenay Power Company, Ltd.; Ottawa-Montreal Power Company, Ltd.; Porcupine Power & Telephone Company, and Quintze Power Company, Ltd.

Jacob F. Schoellkopf, formerly chairman of the executive committee of the Buffalo, Niagara & Eastern Power Corporation, Buffalo, has been elected chairman of the board of directors to succeed the late Charles R. Huntley. At the meeting held Nov. 12 **Fred D. Corey**, formerly first vice-president, was named chairman of the executive committee, and **William R. Huntley**, second vice-president, was elected first vice-president. **Alfred H. Schoellkopf**, a vice-president, was named vice-president and general manager. Other officers were continued. William R. Huntley, who becomes first vice-president, was recently elected president of the Buffalo General Electric Company to succeed his father, the late Charles R. Huntley.

George S. Bartlett, manager of the Pontiac (Ill.) district of the Public Service Company of Northern Illinois, has been promoted to the position of operating superintendent for the company's district "C," headquarters of which are in Evanston. Mr. Bartlett was graduated from the Iowa State College at Ames in 1917 as an electrical engineer, entering the employ of the Public Service Company as an inspector at Kankakee. He served as district engineer and chief clerk in the latter city, after which he was transferred successively to Evanston, the general offices in Chicago and, finally, to Pontiac as district manager. In taking up his new work in Evanston Mr. Bartlett will have the advantage of the acquaintances made during his previous service in that community. He will have general supervision over the various operating and construction departments in the Evanston territory.

R. M. Bayle has been appointed service manager in charge of the new Fairmont service station of the Westinghouse Electric & Manufacturing Company, with headquarters at Fairmont, W. Va. Mr. Bayle joined the Westinghouse company in 1918, having worked in the transformer and rotating machinery departments as tester, as service engineer, Pittsburgh service department, as assistant to the superintendent of the electrical division, Pittsburgh service department, and as supervising field engineer, electrical division, Pittsburgh service department. Mr. Bayle is a member of the American Institute of Electrical Engineers.

Walton Clark of Philadelphia, well-known public utility executive, has resigned as director of the Public Service Corporation of New Jersey after serving 23 years on the board. Mr. Clark was elected a director of the Public Service Corporation at the time of its organization in 1903 and a director of each of the underlying companies as it was organized. The companies the directorate of which he leaves include the Public Service Electric & Gas Company, Public Service Electric Power Company, Public Service Railway Company, Public Service Production Company, Public Service Transportation Company, Public Service Railroad Company and the Public Service Stock & Bond Company. Arthur W. Thompson, president of the United Gas Improvement Company of Philadelphia, was elected to succeed Mr. Clark.

Obituary

Robert W. Day, for many years president of the United Electric Light Company, Springfield, Mass., died Nov. 18, according to a dispatch received by ELECTRICAL WORLD just prior to going to press.

John G. Shedd, a member of the board of directors and of the executive committee of the Commonwealth Edison Company, died Oct. 22. Mr. Shedd became a member of the Edison company's board in 1912.

Walter H. Long, general superintendent of the Edison Light & Power Company, York, Pa., died Nov. 9 at the York Hospital from the effects of an operation. Mr. Long had been affiliated with the local electric power company for 40 years, entering its service as an employee in the power plant which was operated along the tracks of the Pennsylvania Railroad Company. Later he was made the chief engineer of the power plant, and in 1908 he was promoted to the superintendency of the Edison company. In that position he

had full charge of the physical property of this public utility, from its power generating station throughout its distribution system to the point of use by the consumer, and the expansion and improvement of these facilities to meet public needs.

John J. Barnick, superintendent of the Phillipsburg district of the Penn Public Service Corporation, died at his home in that city Oct. 3 after a year's illness. Mr. Barnick was born at Eckley, Pa., 46 years ago. After spending a few years in the railway field he became identified with the Sunbury division of the Pennsylvania Power & Light Company as general superintendent. When the H. D. Walbridge & Company interests obtained control of the public service property at Phillipsburg in 1918 Mr. Barnick assumed the superintendency.

Charles S. Cook

Charles S. Cook, vice-president and treasurer of the Kaestner-Hecht Elevator Company, died suddenly in Pittsburgh Nov. 15. A pioneer in electrical

C. S. Cook

transmission engineering, Mr. Cook was for many years prominently identified with the development of electric power in the industrial district of Pittsburgh. A native of Amherst, Mass., and a graduate of the Worcester Polytechnic Institute, Mr. Cook entered the employ of the Westinghouse Electric & Manufacturing Company at East Pittsburgh in 1887. After serving in the shops and testing room he became construction engineer of building, lighting and power plants before removing to Chicago in 1889 in the capacity of engineering superintendent of construction. In 1892 he laid out the first long-distance transmission system installed in the United States, making it 10,000 volts, when engineering associates thought half that voltage was the commercial limit.

Returning to Pittsburgh in 1895, Mr. Cook took charge of special sales engineering work, subsequently being made manager of the Pittsburgh office. In 1904 he was appointed manager of the railway and lighting department, from which position he retired to become general manager of the Duquesne Light Company. In 1922 he became vice-president. In 1924 he affiliated himself with the Kaestner-Hecht company as vice-president and treasurer, with headquarters in Chicago.

Recent Court Decisions

Responsibility for Death from Heavy Charge on Telephone Wire Due to Contact with High-Tension Wire.—Wieks vs. New York Telephone Company et al. was a suit for damages because of the death of a man from the breaking of a telephone line across his premises and its contact with a Buffalo General Electric power wire. Negligent construction was charged against the predecessor of the New York Telephone Company and negligent maintenance against the latter. The Court of Appeals of New York dismissed the latter contention, since at the time the accident occurred the system was being operated by the federal government, which had taken it over. The court also ordered a retrial of the charges of negligent construction, saying that the evidence was insufficient to show that, because of a long span or because of proximity to heavily charged electric wires, the telephone line was a nuisance to such a degree as to make the company liable for the accident. (153 N. E. 444.)*

What Constitutes Negligence as a Matter of Law.—Injury from contact with a live electric wire which had been broken and hung down in the plaintiff's yard led to a suit for damages (Darden vs. Mayor of Washington). The Georgia Court of Appeals has upheld a verdict for the city, declaring that the mere presence of such a wire did not denote negligence as a matter of law and that the issue was properly submitted to the jury. The trial court, however, properly refused to hold the defendant to a standard of extraordinary care and diligence, and the fact that the plaintiff saw that the wire was hanging from a pole, or could with due diligence have seen so, was, the higher court said, properly made the basis of the following judicial charge, in the language of the Civil Code: "Notice sufficient to excite attention and put a party on inquiry is notice of everything to which it is afterward found such inquiry might have led. Ignorance of a fact due to negligence is equivalent to knowledge in fixing the rights of parties." (134 S. E. 813.)

Lockport (N. Y.) Manufacturers Lose Power Rate Case on Appeal. — The Appellate Division of the New York State Supreme Court at Rochester has handed down a decision in the so-called Lockport power suit reversing the opinion of the Supreme Court in favor of local manufacturers who sought to force the continuance of the sixteen-dollar power-rate contract between the city and the power companies. (See ELECTRICAL WORLD for Dec. 12, 1925, page 1228). The decision is far-reaching in its importance to local power users in manufacturing plants, because unless it be reversed again by a decision of the State Court of Appeals, to which the plaintiffs now have recourse, it will allow the power companies arbitrarily to put into force a new contract superseding the one under which Lockport obtained its so-called cheap power. The case attracted wide attention in June, 1925, when the issue was first heard. The plaintiffs sought to have carried out an alleged agreement entered into in 1906 for the delivery of 20,000 electrical horsepower by the Niagara, Lockport & Ontario Power Company. Other defendants in the action were the Lockport Light, Heat & Power Company, the International Power & Transmission Company and the city of Lockport.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Commission Rulings

Municipal Plant Not to Be Regarded as Furnishing Service in Lieu of Taxes. —The Indiana Public Service Commission has granted authority to the city of Anderson to reduce the rates of its electric light plant. An argument to the effect that the light department should not only be permitted to earn a return sufficient to maintain the integrity of the property and take care of necessary extensions from revenue, but that additional revenue should be earned which could be, from time to time, transferred to the general fund for use in ordinary municipal expenses, was disapproved by the commission. It was the opinion of some that this was justified because the light department did not pay city taxes, but the commission declared that it was not fair, just or lawful to require the patrons of a municipally owned electric plant to pay city taxes either directly or indirectly under the guise of furnishing service in lieu of taxes.

Interconnection Clearly in the Public Interest. — In granting permission to the Nevada Valleys Power Company to extend its transmission system 30 miles in order to tie it in with that of the Truckee River Power Company, which in turn is connected with the network of the Pacific Gas & Electric Company, the Public Service Commission of Nevada said the applicant company had shown that the snowfall during the winter of 1925-26 was far below normal and that the reservoir which supplies water to operate its generating plant depends upon the annual snowfall for its supply, that this year the water is unprecedentedly short and applicant is wholly dependent upon the water supplied by the United States at Lahontan to generate electricity, and that the indications are that there will be a serious shortage of water this season and the generation of power will be materially decreased, thereby jeopardizing the business of the applicant and causing inconvenience and loss to its patrons and customers. The commission emphatically asserted that the policy of co-ordinating the supply of electrical energy by the interconnection of two or more power companies is clearly in the public interest and should receive the indorsement and encouragement of all.

Financial and Corporate

Power Issues in Demand

Money Situation Easy and Keener Interest Shown in Utility Bonds and Preferred Stocks

FOLLOWING indications mentioned last week of increasing interest in the public utility issues, definite strength has developed in these securities. There has been further aggressive buying of power and light stocks, a large proportion of the purchases being for centralized account. This is interpreted by those in touch with the situation as foreshadowing consolidation projects of some magnitude.

Preferred stocks have shown greater firmness during the week as a result of heavier demand on the part, especially, of institutions. In keeping with the general behavior of industrial and other securities, gains have not been much more than marginal.

The level of common-stock prices has not varied greatly from that of last week. Marginal gains were made by Buffalo, Niagara & Eastern Power, Columbia Gas & Electric, Commonwealth Edison, Edison Electric Illuminating of Boston, Pacific Gas & Electric and others. American Gas & Electric receded to 106 from a high of 107¾ last week, and Brooklyn Edison dropped back to 159¼ from 162 last week.

Public utility bond issues have been particularly active during the week. The scarcity of offerings at current prices has pushed quotations up to new high levels, but has not lessened demand. First mortgage bonds were forced to a 5 per cent yield basis, and as a result interest increased in more secondary issues. The Dow, Jones & Company index number of public utility bonds stood at 74.29 for October, which is lower than for any of the four previous months, though otherwise a high level for two years. The index by months during the past two years was:

	1925	1926		1925	1926
January....	70.63	71.99	July.....	71.05	75.14
February...	71.26	73.65	August....	70.66	74.78
March.....	70.03	73.22	September.	70.95	74.67
April.....	69.59	73.69	October....	70.52	74.29
May.....	71.36	74.24	November.	70.65	.....
June.....	72.06	74.89	December..	70.92	.....

Utility bonds have shared the strength displayed by the bond market in general, and prices have shown sustained strength. This is attributed by some to the President's proposal for a rebate on individual and corporation income taxes, which suggests easier money and the release of a large volume of funds for investment.

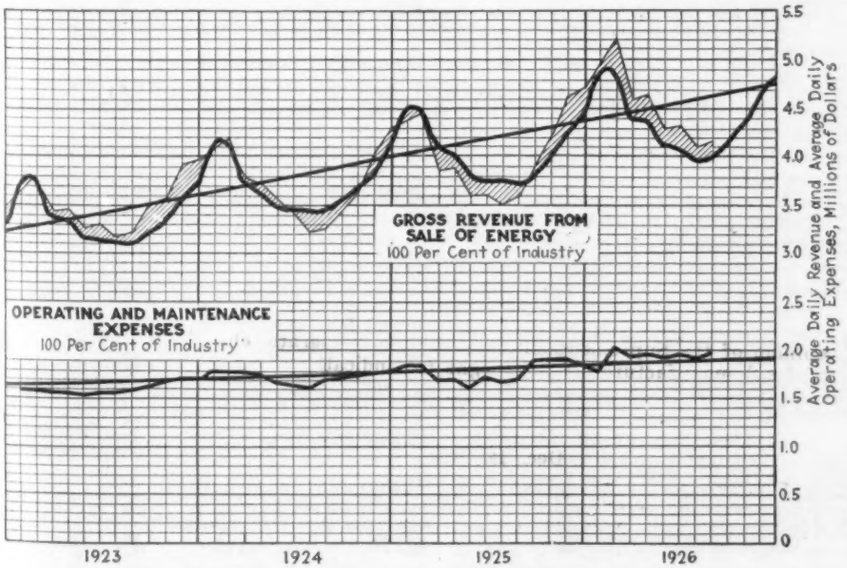
Accumulated Earnings on Utility Stocks

Earning Record of Power and Light Issues Moves Gradually Upward, While Operating Costs Have Been More or Less Stabilized

By H. M. CAMERON
Financial Editor ELECTRICAL WORLD

THAT power and light companies have required nearly five times as much capital as they returned annually in revenue has been a financial handicap in the past. It may contain an element of advantage to common-stock holders in the future. In most cases a conservative policy has been pursued by the companies in the distribution of earnings on common stock. In many cases there is an accumulation of earnings which is yet to be realized upon. Arising out of the same handicap referred to is another outstanding advantage of public utility common stocks, namely, their price stability. A study of the trend of a group of representative utility stocks shows a remarkably even level in comparison with that of industrial issues.

It will be noted from the charts shown that the market crash of last March caused a break of only 8 per cent in the large and representative group of utility stocks studied against a 17 per cent drop in the combined average of industrials and rails and the much larger break in industrials alone. Furthermore, utility stocks almost immediately commenced to recover and by October had recouped almost the entire loss. While they react with the general market securities, their fluctuations are only a fraction of the largest fluctuations of the other issues. This involves an investment quality comparable to that of the better railway stocks.

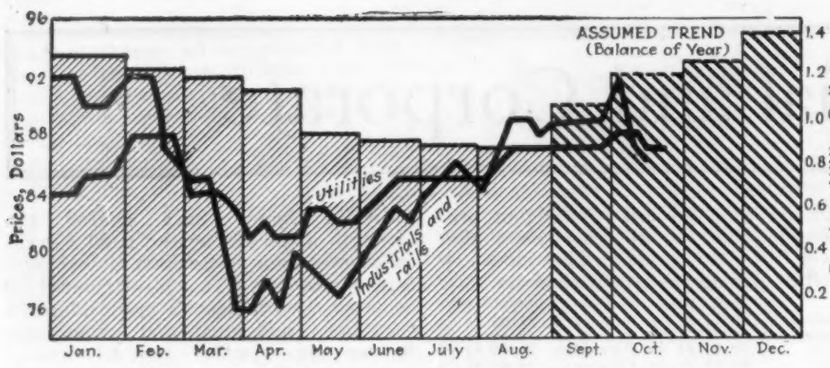


REVENUE GROWS MORE RAPIDLY THAN EXPENSES
Normal trend of gross revenue of power and light companies rises steadily, while operating costs are relatively stable.

SIMILAR SITUATION IN LONG TREND

In the long swing of the stock market the situation is similar. From the bottom of the trough in 1923 utility stocks gained rapidly, in advance, usually, of industrials. The top was reached early this year. Since 1923 there was a rise of more than 8 per cent in the list of utility stocks, considering in this instance both preferred and common issues. A study of the behavior of these stocks since March indicates that the bulk of this long-swing gain is an approach to real values rather than inflated values.

The opinion is expressed by some that the power and light companies are reaching the saturation point in regard to the market for their products. A study of existing and prospective power requirements pushes such a point far into the future. Revenues are still increasing steadily, while operating costs, as shown in the second chart, are more or less fixed. Obviously the divergence of these lines means the continuation of earning growth, assuming relatively stable power and light rates. In the case of some companies the gross revenue line is not increasing so rapidly as the operating cost line, and this is distinctly a danger signal if continued for an extended period. With the companies that are building up their earnings more rapidly than their costs and interest charges, it is especially true that the requirement for larger capital additions than were immediately reflected in revenue has deferred full realization



UTILITY STOCKS FLUCTUATE LESS WIDELY THAN INDUSTRIALS
Trend of utility prices compared with average of 40 industrials and rails computed by the *Annalist*.

of warranted yield by common-stock holders generally. While capital is still required in large quantities for new plants and equipment, it seems reasonable to expect the cumulative effect will mean greater returns on common stock.

With regard to the relation between earnings and prices, there is a suggestion in the second chart that the market discounts earning movements. This is significant in considering probable price movements, since the trend of earnings for the rest of the year will normally be sharply upward, the low point having been reached as usual in midsummer.

New Directors on Commonwealth Edison Board.—Stanley Field and Donald R. McLennan have been elected directors of the Commonwealth Edison Company to succeed the late Robert T. Lincoln and John G. Shedd.

New Capital Issues

During the week ended Nov. 18 the Northern Indiana Public Service Company made an offering of first and refunding mortgage 5 per cent gold bonds, series C, to the amount of $11,500,000. These bonds, maturing Nov. 1, 1966, were priced at 98½ and interest. The mortgage under which these bonds were issued covered all fixed property now owned or hereafter acquired, subject to the outstanding divisional bonds, if any, on properties at the time of their acquisition and those thereafter issued for pledge under the mortgage. Proceeds of these bonds will be used to retire and cancel 6 per cent series A bonds outstanding under the first and refunding mortgage amounting to $2,500,000 and $4,500,000 three-year 5½ per cent secured gold notes, series A, issued by the Northern Indiana Gas & Electric Company, which property is to be acquired by the Northern Indiana Public Service Company. Proceeds will also be used toward reimbursing the company for capital expenditures heretofore made

Stock Quotations of Electric Light and Power and Manufacturing Companies

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par, stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 16	Low 1926	High 1926
ABITIBI PWR. & PAPER, com. —no par	91½	70½	98
Adirondack Pwr. & Lt.—7% pf.	103	....	....
Adirondack Pwr. & Lt.—8% pf.	111	....	....
Ala. Pwr., pf.	107	....	....
Allis-Chalmers Mfg. pf.	109½	105	110½
Allis-Chalmers Mfg., com.	87½	78½	94½
Aluminum Co. of Amer., com.	70½	54½	76
Aluminum Co. of Amer. pf.	102½	98½	102½
Amer. & Foreign Pwr., pf. 25% pd.	*m*110	....	....
Amer. & Foreign Pwr., 7% pf.—no par	84½	70	98
Amer. & Foreign Pwr., com.—no par	18	14½	42½
Amer. Bosch Magneto, com—no par	16½	16	34½
Amer. Brown Boveri, Elec.	41½	30½	50
Amer. Brown Boveri, Elec., pf.	*k* 96	86½	97½
Amer. Gas & Elec., 6% pf.—no par.	95½	....	....
Amer. Gas & Elec., com.—no par.	107½	64	110½
Amer. Lt. & Trac., 6% pf.	119½	105	124
Amer. Lt. & Trac., com.	215½	193	263
Amer. Pwr. & Lt., 6% pf.	98½	92	99½
Amer. Pwr. & Lt., com.—no par.	*m* 66½	50½	72
Amer. Pub. Serv., 7% pf.—no	*k* 96	92	97½
Amer. Pub. Serv., com.	50	....	....
Amer. Pub. Utilities, 6% pf.	77	....	....
Amer. Pub. Utilities, 7% pf.	89	....	....
Amer. Pub. Utilities, com.	68	....	....
Amer. States Sec., A	2½	....	....
Amer. States Sec. B	2½	....	....
Amer. Superpwr., pf.—25	*k* 26½	23	26½
Amer. Superpower, pf.	94½	....	....
Amer. Superpwr., Class A—no par.	*k* 29	19½	37½
Amer. Superpwr., Class B—no par.	30	21½	39
Amer. Wtr. Wks. & Elec., 7% pf.	*k*101½	101½	108½
Amer. Wtr Wks. & Elec., com.—20	58	43½	74
Anaconda Copper	49½	41½	51½
Appalachian Elec. Pwr., 7% pf.	98	....	....
Appalachian Ele. Pwr., 1st pf., 7%	98	....	....
Appalachian Elec. Pwr., com.	*m* 78	....	....
Arizona Pwr., 7% pf.	73½	....	....
Arizona Pwr., com.	22½	....	....
Arkansas Cent. Pwr., pf., $7—no par	*k*101	99	107½
Arkansas Lt. & Pwr., 7% pf.—no par	101	....	....
Arkansas Lt. & Pwr., com.—no par.	100	....	....
Asheville Pwr. & Lt., 7% pf.—no par	*f*107	100½	107½
Assoc. G. & E., pf.—$3.50—50	50	....	....
Assoc. Gas & Elec., pf.—$6—no par	83	....	....
Assoc. Gas & Elec., Class A—no par	35	25½	38½
BABCOCK & WILCOX, com.	118	112	149
Binghamton Lt., Ht. & Pwr., pf.	90	....	....
Birmingham Elec. pf.—$7—no par.	105	....	....
Blackstone Valley Gas & Elec., pf.	103	....	....
Blackstone Valley G.&E., com.—50	*k*101	100½	106
Blaw-Knox, com.	*k* 74	45	80
Brazilian Trac., Lt. & Pwr., com.	*f*105	....	....
Broad River Pwr., pf.	94	....	....
Brooklyn Edison, com.	159½	133	163
Buffalo, Niagara&East.Pwr.,pf.—25.	25	....	....
Buffalo, Niagara & Eastern Pwr., com.—no par.	30	....	....
CALIFORNIA ELEC. GENERATING, pf.	93	....	....
California Ry. & Pwr., pf.	130	....	....
Carolina Pwr. & Lt., pf.—$7—no par	107	....	....
Cent. & S. W. Ut. 7% pf.—no par	*a* 91½	89½	96½
Cent. & S. W. Ut., pr. ln. pf.—no par	*a* 99	93	100
Central Ariz. Lt. & Pwr., pf.	104½	....	....
Central Ark. Ry. & Lt., 7% pf.	99	....	....
Central Ill. Pub. Serv., 6% pf.	*a* 88½	....	....
Central Ind. Pwr., 7% pf.	*l* 84½	....	....
Central Pwr. & Lt., pf.	99	....	....
Central States Elec., 7% pf.	92	....	....
Central States Elec., com.	*m*200	200	230
Century Elec., com.	*m*117	110	117
Chicago Fuse Mfg., com., no par.	*m* 32	30	35
Cincinnati Gas & Elec., com.	*g* 93	....	....
Cities Service, 6% pf.	*l* 92½	86½	92½
Cities Service, pf.B—10.	*l* 8½	7½	8½
Cities Service, pf. BB—100.	*l* 82½	74	82½
Cities Service, com.—20.	*l* 48½	37½	48½
Cities Service, Bka. Shrs.—10.	*l* 24½	19½	24½
Clarion River Pwr., pf.	95	....	....
Cleveland Elec. Illg., 6% pf.	106½	....	....
Cleveland Elec. Illg., com.	295	....	....
Colorado Pwr., 7% pf.	*k* 95	96	97
Columbia Gas & Elec., 7% pf.	114½	111½	115½
Columbia Gas & E., com.—no par.	*k* 85½	63½	90
Columbia Ry., Gas & Elec., 6% pf.	90	....	....
Columbus Elec. & Pwr., 2d pf.	104½	....	....
Columbus Elec. & Pwr., new com.	48	....	....
Columbus Ry., Pwr. & Lt., 1st pf.	99	....	....
Columbus Ry., Pwr. & Lt., pf. B.	93	....	....
Col. Ry., Pwr. & Lt., com.—no par.	69	....	....
Commonwealth Edison, com.	*a*136½	....	....
Commonwealth Pwr., 6% pf.	90½	82	91
Commonwealth Pwr., com—no par.	42	28½	43½
Conn. Lt. & Pwr., 8% pf.	117	....	....
Conn. Lt. & Pwr., 7% pf.	109	....	....
Cons. Gas of N. Y., pf.—50.	58½	....	....
Cons. Gas of N.Y., com.—no par	108½	87	115½
Cons. Gas Elec. Lt. & Pwr. of Balti., 6% pf.	*m*105	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 6½% pf.	*e*111	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 7% pf.	*e*113	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. 8% pf.	*e*126½	....	....
Cons. Gas, Elec. Lt. & Pwr. of Balti. com.—no par.	*e* 52½	45	57½
Cons. Pwr. & Lt., 7% pf.	105	....	....
Consumers Pwr., 6% pf.	97½	....	....
Consumers Pwr., 6.6% pf.	103	....	....
Continental Gas & Elec., 7% pfc. pf	102½	....	....
Continental Gas & Elec., 7% pr. pf.	97½	....	....
Continental G.&E., com.—no par.	180	....	....
Crocker Wheeler, com.	21½	....	....
Crocker Wheeler, pf.	60	....	....
DALLAS PWR. & LT., 7% pf.	107	....	....
Dayton Pwr. & Lt., 6% pf.	100	....	....
Detroit Edison, com.	134½	123½	141½
Dubilier Condenser com.—no par.	5	3½	11
Dubuque Elec., 6% pf.	94	93	98½
Duquesne Lt., 7% pf.	*k*115½	111½	116½
EAST. N. Y. UTIL. pf.	100	....	....
Eastern New York Util., com.	65	....	....
Eastern States Power.	12½	....	....
Eastern States Power, pf.	90	....	....
Eastern Tex. Elec., 7% pf.	105	....	....
East. Tex. Elec., com.—no par.	75	....	....
Edison Elec. Illum. of Boston, com.	*d*221	....	....
E. Paso Elec., com.—no par.	*m*70	....	....
E. Paso Elec. pf.	103	....	....
Elec. Bond & Share, 6% pf.	*l*106	103½	109½
E. Bd. & Share Sec., com.—no par.	*l* 68½	56½	86
El. Household Util.	*a* 17	11½	25
Elec. Investors, 6% pf.—no par.	93	....	....
Elec. Investors, com.—no par.	41½	30½	74½
Elec. Investors, 10% pd. receipts.	25	....	....
Elec. Pwr. & Lt., ctfs, pf.	95½	89½	98½
Elec. Pwr. & Lt., ctfs., 40% pd.	103½	99½	115
Elec. Pwr. & Lt., ctfs. full pd.	*k*101½	102	110½
Elec. Pwr. & Lt., ctfs., com—no par.	18½	15½	34½
Elec. Refrig.	45	43½	78½
Elec. Ry. Securities, com.—no par.	5½	4	10
Elec. Storage Battery, com.—no par.	83½	71½	94½
Elmira Wtr., Lt. & R. R., 7% pf.	100	98	101½
Emerson Elec., pf.	*m*101	100	104½
Empire Dist. Elec., 6% pf.	*l* 90	82	90
Empire Power, A	26½	....	....
Engr. Pub. Serv., pf.—no par.	94	92½	96½
Engr. Pub. Serv., com.—no par.	23	19½	24½
Eureka Vac. Cleaner, com.—no par.	57½	43	58
FAIRBANKS MORSE, pf.	*k* 48½	108	115
Fairbanks Morse, com.—no par.	*k* 43½	40½	59½
Federal Lt. & Trac., com.	39½	28	40½
Federal Light & Traction, pf.	*k* 88	86	91½
Federal Utilities, pf.	*m* 70	....	....
Federal Utilities, com.	*m* 17	....	....
Ft. Worth Pwr. & Lt., 7% pf.	*l* 108	105	108½
GALVESTON-HOUSTON ELEC., 6% pf.	61	....	....
Galveston-Hstn. El., com.	20	....	....
Gen. Elec., com.	86½	79	95½
Gen. Elec., special—10.	11½	11	11½
Gen. G.&E., (Del.) com. A no par.	43	34	59
Gen. G.&E., (Del.) com. B no par.	*m* 37½	36	48½
Gen. G.&E., (Del.) A pf. $8 no par.	*k*111	105½	113
Gen. G.&E., (Del.) A pf. $7 no par.	*k* 98½	95	99½
Gen. G.&E., (Del) pf. B	*k* 93½	92½	96
General Public Service, pf.	*m*103	100	106
General Public Service, com.	*k* 11½	11½	16½
Ga. Lt., Pwr., & Rys., 6% pf.	89	82	98
Ga. Lt., Pwr. & Rys., com.	*m* 60	65	80
Ga. Ry. & Power, 8% pf.	*k*114	112	114
Ga. Ry. & Power, 7% pf.	106	....	....
Ga. Ry. & Pwr., 4% pf.	*m*114	....	....
Ga. Ry. & Pwr., com.	120	....	....
Gt. Western Pwr., 7% pf.	*h*102	....	....
IDAHO PWR., 7% pf.	102½	....	....
Ill. No. Utilities, 6% pf.	*k* 88	88	92
Ill. Pwr. & Lt., 7% pf.	98	....	....
Ingersoll Rand.	*k* 94	80½	101
Int. Combus. Engr., com.—no par	43½	33½	64½
Int. Utilities, class A—no par.	*m* 29	25	39
Int. Utilities, class B—no par.	*k* 4½	3½	9½
Interstate Pwr., pf., no par.	92	....	....
Interstate Pub. Serv., 7% pf.	98	96	99
Iowa Ry. & Lt., 7% pf.	95	....	....
JERSEY CENTRAL PWR. & LT., 7% pf.	96	....	....
Jersey Central Pwr. & Lt., ptc., pf.	108	....	....
Jersey Central Pwr. & Lt., com.—no par.	*k* 25	25	50
Johns-Manville, com.—no par.	165½	130	165½

Stock Exchange: *a*Chicago; *b*St. Louis; *c*Philadelphia; *d*Boston; *e*Baltimore; *f*Montreal; *g*Cincinnati; *h*San Francisco; *i*Pittsburgh; *j*Washington. *k*Bid, low, high. Saturday, Nov. 13. *l*Bid, low, high, Wednesday, Nov. 17. *m*Latest quotations available.

Stock Quotations of Electric Light and Power and Manufacturing Companies (Continued)

(Prices on New York stock market unless otherwise noted. Unless otherwise noted the par stated, or preference value of stock is $100.)

Companies	Bid Price Tuesday Nov. 16	Low 1926	High 1926
KANSAS CITY PWR. & LT., pf..	k112	107¼	113¼
Kansas Gas & Elec., 7% pf. ex. div.	l103½	99	103½
Kentucky Hydro-Elec., pf.	m 93½	91¼	95½
Kentucky Sec., 6% pf.	81	75	85
Kentucky Sec., com.	101	....	....
Kentucky Utilities, 6% pf.	94	90	95
Keystone Pwr. & Lt. 7% pf.	96	95	97
LA CLEDE GAS LT., com.	k159	146	175½
Lehigh Pwr. Sec., com.—no par	16½	10	22
Long Island Ltg., 7% pf.	108	....	....
Long Island Ltg., com.—no par	130	....	....
Los Angeles Gas & Elec., 6% pf.	98	....	....
Louisville Gas & Elec., Class. A	24½	22½	26½
MANHATTAN ELEC. SUPPLY..	54½	44	87½
Manila Elec., com.—no par	k 40	27½	45½
Maytag Mfg., com.	k 22½	19	24½
Memphis Pwr. & Lt., pf., $7, no par	108	....	....
Metro. Edison, pf.—$6—no par	93½	....	....
Metropolitan Edison, pf., $7, no par.	104	....	....
Metropolitan Edison, com., no par..	k 55	45	55
Middle West Utilities, 7% pf.	a104½	....	....
Middle West Utilities, 7% pr. lien pf.	a115½	....	....
Middle West Utilities, com.—no par.	a112	....	....
Midland Utilities, pr. In. pf.	a 99	....	....
Midland Utilities pf. A.	a 98	....	....
Milwaukee Elec. Ry. & Lt., 7% pf.	101	....	....
Milwaukee Elec. Ry. & Lt., 6% pf..	97	....	....
Minn. Pwr. & Lt., 7% pf.	l104½	100	104½
Miss. Pwr. & Lt., pf.	105½	....	....
Miss. River Pwr., 6% pf.	94½	....	....
Miss. River Pwr., com.	60	....	....
Mohawk Hudson Pwr., 1st pf.—$7 no par	102	....	....
Mohawk Hudson Pwr., 2nd pf.—$7—no par	99	....	....
Mohawk Hudson Pwr., com.—no par	24½	20½	28½
Montana Pwr., pf.	m117½	112½	119½
Montana Pwr., com.	85½	69½	86½
Montreal Pwr., com.	f 72½	....	....
Mountain States Pwr. pf.	96	....	....
Mountain States Pwr., com.	18	....	....
NASSAU & SUFFOLK, LTG., pf.	98	....	....
National Carbon, pf.	a125	124	128
National Electric Pwr-A.	a 21½	19½	26½
National Elec. Pwr., pf.	m 93½	92	96½
Nat. Lt., Ht. & Pwr., com.	24	....	....
National Lt., Ht. & Pwr., 5% pf..	72	....	....
National Pwr. & Lt., pf., $7—no par.	101½	96	102½
National Pwr. & Lt., com.—no par..	21½	16½	38½
National Pub. Serv., 7% pf.	89	....	....
National Pub. Serv., pte. pf.	108	....	....
National Pub. Serv., A com.—no par.	k 19½	15½	24
National Pub. Serv., B com.—no par.	k 14½	10	16½
Nebraska Pwr., 7% pf., ex. div.	l106½	103	107½
Nevada-Calif., Elec., com.	m 20	18½	44½
New Brunswick Pwr., pf.	58	....	....
New England Pub. Serv., pr. In. pf..	99	....	....
New England Pub. Serv., pf.	92	....	....
N. J. Pwr. & Lt., 7% pf.	109½	....	....
New Orleans Pub. Serv., 7% pf.	103	....	....
N. Y. & Queens Elec. Lt. & Pwr., 5% pf.	90	....	....
N. Y. Central Elec., 7% pf.	98½	....	....
Newport News & Hampton Ry., Gas & Elec., com.	109	98	112
Newport News & Hampton Ry., Gas & Elec., pf.	109	....	....
Niagara Falls Pwr., 7% pf.—25..	28½	27½	28½
Niagara, Lock. & Ont. Pwr., 7% pf..	109	....	....
No. Amer., 6% pf.—50.	k 50½	49	52½
No. Amer., com.—10.	50	42	67
No. Amer. Edison pf.—no par.	k 96	91½	96½
No. Amer. Lt. & Pwr., pf.	101	88	104
No. American Utilities, pf., full pd..	m 94½	89	96
No. American Utilities, pf., 25% pd.	m 19	18	27
N.C. Pub. Serv., pf.—$7—no par.	93	....	....
Northeastern Pwr., com.	18½	15½	36½
No. Indiana Gas & Elec., pf. A.	100	98	103½
No. Indiana Public Service—pf.	100	....	103½
No. N. Y. Utilities, 7% pf.	103	....	....
No. Ohio Pwr., com.—no par	13½	11	26½
No. Ohio Trac. & Lt., 6% pf.	78	....	....
No. Ohio Trac. & Lt., 7% pf.	92	....	....
No. Ont. Lt. & Pwr., pf.	83	....	....
No. Ont. Lt. & Pwr., com.	73	....	....
No. States Pwr., 7% pf.	101½	....	....
No. States Pwr. com.	107½	97	136½
No. Texas Elec., 6% pf.	51	....	....
No. Texas Elec., com.	17	....	....
OHIO BRASS, com. B—no par...	76	70	80
Ohio Brass, pf.	100	98	101
Ohio Gas & Elec., 7% pf.	94	....	....
Ohio Pwr., 6% pf.	95½	....	....
Ohio Pub. Serv., 6% pf.	l 94½	90	96½
Ohio Pub. Serv., 7% pf.	l103	96	103
Ohio River Edison, pf.	103	....	....
Oklahoma Gas & Elec., pf.	96	....	....
PACIFIC GAS & ELEC., 6% pf...	99½	....	....
Pacific Gas & Elec. com.	k130	118	133½
Pacific Pwr. & Lt., 7% pf.	l102½	98	102½
Parr Shoals Pwr., 6% pf.	92	....	....
Penn Central Lt & Pwr., pf.—no par	c 73	....	....
Penn-Ohio Edison, 7% pf.	96	....	....
Penn-Ohio Elec., 7% pf.	95	....	....
Penn-Ohio Pwr. & Lt., 7% pf.	98	....	....
Penn-Ohio Pwr., & Lt., 8% pf.	108	....	....
Penn Pwr. & Lt.—$7—no par.	l106½	103	108½
Penn Pub. Serv., 7% pf.	103	96	103
Penn Pub. Serv., 6% pf.	87	85	90
Penn Wtr. & Pwr., com.	c167	141	171
Phila. Co., 6% pf.—50.	49½	45	51½
Phila. Co., com.—50.	77	59½	77
Phila. Elec., com.—25.	c 51½	....	....
Pittsburgh Utilities, pf.—10.	m 19½	14½	20½
Portland Elec. Pwr., 7% pf.	97	....	....
Portland Elec. Pwr., 6% pf.	83	....	....
Portland Elec. Pwr., 6% 2nd pf.	70	....	....
Portland Elec. Pwr., com.	28	....	....
Potomac Elec. Pwr. pf.	j107½	....	....
Pwr. Corp. of N.Y., com—no par..	m 79	77½	90½
Pwr. Sec., pf.—no par.	k 24	10	29
Pwr. Sec., com.—no par.	k 6	4	13
Pub. Serv. of Colorado 7% pf.	l 99	96	100
Pub. Serv. of N. J., 7% pf.	k109½	103½	109½
Pub. Serv. of N. J., 8% pf.	k123½	115	124½
Pub. Serv. of N. J., com.—no par..	32	31½	32½
Pub. Serv. of No. Ill., 6% pf.	k101	101	103
Public Serv. of No. Ill., 7% pf.	a114	112	116½
Pub. Serv. of No. Ill., com.—no par	a129½	127	140
Pub. Serv. of No. Ill., com.	m130	128	143
Pub. Serv. of Okla., 7% pf.	98½	92	100
Pub. Serv. Elec. & Gas, 6% pf.	102½	97	104½
Public Service Elec. Pwr., pf.	k112½	106	114
Puget Sound Pwr. & Lt., 7% pf..	103	....	....
Puget Sound Pwr. & Lt., 6% pf..	83½	....	....
Puget Sound Pwr., & Lt., com.	28½	26	66½
RADIO CORP. OF AM., pf.—50 .	k 50½	44½	50½
Radio Corp. of Amer., com —no par.	60½	32	60½
Republic Ry. & Lt., pf.	110	....	....
Republic Ry. & Lt., com.	92	....	....
Rochester Gas & Elec., 5% pf..	m 95	80	98
Rochester Gas & Elec., 6% pf..	k 95	80	98
Rochester Gas & Elec., 7% pf..	105	....	....
SAN JOAQUIN LT. & PWR., 7% pf.	106	97½	108
Safety Cable, com.	54	42½	55½
St. Joseph Ry., Lt., Ht. & Pwr., pf..	67	60	70
Servel Corp.,	13½	12½	22½
Sierra Pacific Elec., com.	23½	....	....
Sioux City Gas & Elec., 7% pf.	98½	....	....
S. E. Pwr. & Lt., pf.—$7—no par..	99½	....	....
Southeastern Pwr. & Lt., pte. pf..	67	....	....
S. E. Pwr. & Lt., com.—no par..	33½	20	46½
So. Calif. Edison, 8% pf.—25..	32	....	....
So. Calif. Edison, 7% pf.—25..	27½	....	....
So. Calif. Edison, 6% pf.—25..	24½	....	....
So. Calif. Edison, com.	31	30½	33
Southern Cities Utilities, 7% pf..	86	....	....
Southern Cities Utilities, com.	37	28	49
Southwestern Lt. & Pwr., A.	60	....	....
Southwestern Lt. & Pwr., B.	60	....	....
Southwestern Lt. & Pwr., $6 pf.	82	....	....
Southwestern Pwr. & Lt., 7% pf..	k103½	100	105
Springfield (Mo.) Ry & Lt., 7% pf.	97	95	100
Standard Gas & Elec., 8% pf.	56½	53½	57½
Standard Gas & Elec., 7% pf.	101½	....	....
Standard Gas & Elec., com.—no par.	55	51	69
Standard Pwr. & Lt., 7% pf.	96	....	....
Staten Island Edison, pf.—$6—no par	94½	....	....
Superheater, com.—no par.	153	....	....
Syracuse Lighting, 7% pf.	102	105	107
Syracuse Lighting, 8% pf.	115	....	....
Syracuse Lighting, com.	340	260	355
TAMPA ELEC., com..	46	....	....
Tenn. Elec. Pwr., 6% pf.	90	....	....
Tenn. Elec. Pwr., 7% pf.	102	....	....
Terre Haute, Ind. & East Trac., pf..	20	20	37
Terre Haute, Ind. & East. Trac., com	1	1	7
Tex. Pwr. & Lt., 7% pf.	l 107½	102	107½
Tide Water Pwr., 8% pf.	104	....	....
Timken Roller Bearing, com—no par	85½	44½	86½
Toledo Edison, 8% pf.	l114	111	114
Toledo Edison, 7% pf.	l103	101	103
Toledo Edison, 6% pf.	l 94½	90	95
Toledo Edison, com.	100	....	....
Tri-City Ry. & Lt., 6% pf.	89	87½	89
UNITED GAS & ELEC., 6% pf..	98½	....	....
United Gas & Elec., com.—no par.	m 57	56	66
United Gas & Elec. (N.J.), 5% pf....	71	....	....
United Gas Impr.—50.	c1 11½	....	....
United Lt. & Pwr. pf.—$4—no par.	49½	44	51
United L. & P. pf.—$6.50—no par..	87	81	91
United Lt. & Pwr., com., A—no par	14½	10½	28
United Lt. & Pwr. com., B—no par	13½	15	31
Utah Pwr. & Lt., 7% pf.	l 103	99	103½
Utica Gas & Elec., 7% pf.	105	....	....
Utica Gas & Elec., com.	200	....	....
Utilities Pwr., & Lt., 7% pf.	92	....	....
Utilities Pwr. & Lt., com A.	30½	26½	37
Utilities Pwr. & Lt., com. B—no par	k 14	13½	18
VERMONT HYDRO - ELEC., 7% pf.	95½	94	96
Virginia Elec. & Pwr., 7% pf.	104	101	105
Virginia Pwr., 7% pf.	108	102	104
Virginian Pwr., com.	70	65	75
WAGNER ELEC., pf.	b 68½	....	....
Wagner Elec., com.—no par.	b 21	....	....
Washington Ry. & Elec., com.	j183	....	....
Washington Ry. & Elec., pf.	j 90½	....	....
Washington Wtr. Pwr., com.	133	130	136
West Mo. Pwr., 7% pf.	m 92	....	....
West Penn., 7% pf.	m113½	108	115
West Penn, com.	m125	118	130
West Penn Elec., pf.	100½	95½	101
West Penn Elec., Class A.	k 97	88½	98½
West Penn Pwr., 6% pf.	k113	108	115
West Va. Lt., Ht. & Pwr., 7% pf..	94½	95	98
West Va. Utilities, 7% pf.—50.	48½	43	51
Western Pwr., 7% pf.	97½	91½	99
Western States Gas & Elec., 7% pf.	93	....	....
Western States Cas & Elec., com.	17	....	....
Westinghouse El. & Mfg., com—50	69½	65	79½
Weston Elec. Instrument, Class A..	k 32	27½	32½
Weston Elec. Instrument, com.	k 16½	13½	19½
Wheeling Elec., pf.	95	91	97
Wis. Pwr., Lt. & Ht., 7% pf	k 95	85	90
Worthington Pump, pf. A.	k 45	51	80
Worthington Pump, pf. B.	k 39	39	65
Worthington Pump, com.	22½	19½	44½
YADKIN RIVER PWR., 7% pf...	l107	102	107½
Yale & Towne, com.—25.	k 68½	60½	72½

Stock Exchange: aChicago; bSt. Louis; cPhiladelphia; dBoston; eBaltimore; fMontreal; gCincinnati; hSan Francisco; iPittsburgh; jWashington. kBid, low, high, Saturday, Nov. 13. lBid, low, high, Wednesday, Nov. 17. mLatest quotations available.

and for the expansion of its general gas and electric service to provide for the rapid growth of its territory.

One of the largest short-term public utility issues in recent weeks, the ten-million-dollar Public Service Company of Northern Illinois 5 per cent debentures, was offered during the week under review. The price of the debentures, which mature Sept. 1, 1931, was 99.50 and interest, yielding over 5.10 per cent. The debentures will be a direct obligation of the company and precede 100,000 shares of outstanding preferred stock paying $6 per share per annum, 63,576 shares of outstanding preferred stock paying $7 per annum and 297,371 shares of outstanding common stock paying $8 per annum, all having a combined market value, as indicated by recent quotations, of over $55,500,000.

Another sizable loan was floated by the Western Power Corporation in the form of 5½ per cent convertible collateral trust gold bonds, amounting to $10,000,000, the price being 99 and accrued interest to yield about 5.55 per cent. These series A bonds will be convertible at their principal amount on or before Jan. 2, 1940, or prior redemption, into common stock ($10 par value) of the North American Company.

The Potomac Edison Company contributed $11,250,000 to the week's total in the form of first mortgage 5 per cent gold bonds priced at 97 and interest. These bonds are secured by a direct first mortgage on all the physical properties of the company, subject to only $229,000 mortgage bonds on a small division of the property.

The Public Service Company of New Hampshire issued first and refunding mortgage 5 per cent gold bonds, series A, to the amount of $3,150,000, the price being 99 and interest to yield over 5.06 per cent.

Penn-Ohio Securities to Redeem Stock.—All of the outstanding $6 cumulative preferred stock of the Penn-Ohio Securities Corporation has been called for redemption Nov. 30, the holder of each share to receive in exchange one share of the $6 cumulative preferred stock of the Penn-Ohio Edison.

Tenney Offers to Buy Salem Gas Light.—Charles H. Tenney & Company, Boston, have offered to purchase the Salem (Mass.) Gas Light Company and to operate it as one of the constituents of the North Boston Lighting Properties. The Salem Electric Lighting Company has been managed by the Tenney interests for seventeen years. The directors of the Gas Light Company have accepted the offer on condition that all the stockholders of the company shall have the opportunity to sell their holdings upon the terms offered, the expiration date of the offer being Dec. 16.

Terminable Permit Aid to Financing

Obviates Condition Under Which Companies Cannot Sell Bonds Extending Past Life of Franchise and Difficulty Incurred in Getting New One

By H. V. Bozell
Of Bonbright & Company, Inc., New York

ACTION taken by the last Oklahoma Legislature in enacting a terminable permit law for public utilities and the interest now being displayed in this legislation by other states bring into the limelight the relation of the franchise terms to one of the most important factors in utility operation, namely, the financing of the utility under the franchise. The life of the franchise has a very direct bearing not only upon the cost of financing, but also upon the question as to whether sound financing is even possible. The terminable permit, of course, has no definite stated life. There has not yet been enough experience with it to provide a basis for extensive statistics with reference to its effect on financing. But there are enough occurrences, and there is enough experience with other franchises of varying length from which conclusions can be drawn, to lead to the conviction that the terminable permit is a definite aid to more stable and cheaper financing than is possible under short-term franchises. A utility with fixed property and with its franchise ending is decidedly at a disadvantage in negotiating for a new franchise. There are also cases in which a new franchise has actually been refused to the utility, thus putting in great doubt just how much value still attaches to the property. The property certainly has no well-defined legal standing, and while it is not probable that it will be confiscated or that there will be a complete loss of value under modern regulatory practice, yet there is no definite assurance as to the outcome.

Under such conditions it is a fact that bonds are issued only in very rare cases for a term extending beyond the life of a franchise. This naturally means a short-life bond, except for bonds issued during the early years of the life of a long-term franchise, and that the bond discount or expense of selling the bonds must be amortized over a comparatively short period at consequently higher rates per year than would be the case if a bond with a much longer term could be issued. Furthermore, since bonds in the public utility business are usually paid off by a refunding operation, the natural result is that, even if the franchise is renewed, the refinancing operation must be gone through, with the expense of marketing again assumed.

Furthermore, many insurance companies and other large institutional investors that absorb a large part of the senior money in utilities are prohibited from buying bonds that extend past the life of the franchise. This means that the market is considerably restricted, and naturally this results in a higher interest rate or the equivalent—a consequent lowering of the possible sale price to the banker and public.

In the rare cases where bonds are issued for a term extending beyond the franchise life of the property covered it is usually in a consolidated group of properties or, in the case of a small holding company, where there are a number of properties each with its independent franchise, all expiring at different dates. With this diversity of risk the total risk is automatically reduced. Even then, however, the price at which the bonds can be sold is lower.

Property Within Two States

Two examples may illustrate: The first was an issue covering the property of a company with property within two states. The property in one state was covered by perpetual franchise; the properties in the other state were covered by franchises expiring at various dates between 1937 and 1950. Bonds expiring in 1954 were issued. Protection of the properties in the state with perpetual franchises, plus the diversity of risk in the state with the term franchises, made the issue possible, but the price at which the bonds were sold was lower than it would have been had they all been covered by perpetual franchise.

In the second case—a very recent bond issue—the banker had to refuse to issue bonds for as long a term as requested because that term went beyond the life of the franchises, and, second, was forced to make his price lower than it would have been otherwise because the due date of the bonds even approached the termination of the franchises. This is a case, however, of a group of properties in which the franchises all terminate at about the same time.

As a matter of fact, not only are bonds not issued beyond franchise life, but usually they are not issued to mature within two or three years of the franchise life. The reason for this is that since bonds must usually be paid by refunding, as mentioned above, it is not desirable to place a company in the position of trying to refund within only two or three years of franchise life. Such refunding must usually be done with short-term, high-interest-rate notes or bank notes at best, and the cost of obtaining these, together with the high annual charges, is an undue charge on the company and consequently on the public. Furthermore, this naturally restricts or eliminates entirely the construction of needed extensions to the property, and service consequently deteriorates, to the detriment of the entire community.

Applies Also to Stock

Most of the discussion thus far has been apparently directed toward bond financing, yet it should be pointed out that the same arguments all apply to financing done by the use of debentures or preferred stock to almost as great a degree. The fact that the property of the utility is mortgaged as security for the bond may seem to give more tangible connection to franchise life and its relation to bonding, yet if there is going to be any disturbance at all which would tend to reduce the actual emergency value of the physical property to any degree, the bondholders at least have the greatest protection and the greatest chance of getting their money in a forced liquidation. This means that the junior money runs even greater risk of loss in such a case and therefore is even more subject to the effect which franchise life may have on the price of securities. One of the largest, most conservative and most astute investing institutions in America was considering the purchase of a large block of bonds of a company in Oklahoma. Decision against the purchase was made on account of the franchise situation there. Subsequently Oklahoma passed her indeterminate franchise law, and on account of that and that alone this large institution decided to purchase the very block of bonds which had previously been decided against.

It is difficult to give much concrete evidence with reference to the effect of a terminable permit as against a term franchise on price or interest rate of securities, and the reason is that there are no two cases that are identical in all conditions other than the franchises so that the franchise situation could be given as the sole reason for difference in price. Even if there were a single company, first, before the terminable permit law was passed and, second, after such law was passed, the general market situation would probably have changed meanwhile, so that differences in price could not be attributed solely to the franchise situation. This much is true, however—that in determining the price at which to sell a security, various factors are considered in reaching the judgment, and one of the factors considered is this franchise question. It is safe to say that there is unanimous agreement among investment bankers that a company operating under a terminable permit law is in a good position to get its money at lower rates than one operating under a term franchise.

Dividends Declared

The quarterly dividends listed below have been announced by electric light and power and electrical manufacturing companies:

Name of Company	Per Cent	When Payable
American Power & Light, com.	$0.25	Dec. 1
Baton Rouge Elec., pf. A	1¾	Dec. 1
Blackstone Valley Gas & Elec., com.	$1.25	Dec. 1
Blackstone Valley Gas & Elec., pf.	3	Dec. 1
Central Indiana Power, pf.	1¾	Dec. 1
Cleveland Elec. Illg., 6% pf.	1½	Dec. 1
Electric Storage Battery, com. & pf.	$1.25	Jan. 3
Georgia Railway & Elec., com.	2	Nov. 20
Kentucky Hydro-Elec., pf.	1¾	Dec. 20
Laclede Gas & Elec., pr. ln. stk.	1¾	Dec. 1
Middle West Utilities, pr. ln.	$2	Dec. 15
Monongahela West Penn Public Service, 7% pf.	.43¾	Jan. 1
Nebraska Power, pf.	1¾	Dec. 1
North Carolina Public Service, pf.	$1.75	Dec. 1
Northern States Power (Wis.) pf.	1¾	Dec. 1
Northwestern Public Service, pf.	1¾	Dec. 1
Oklahoma Gas & Elec., pf.	1¾	Dec. 15
Philadelphia Electric	.50	Dec. 15
Radio Corporation of America, pf.	1¾	Jan. 1
Rochester Gas & Elec., pf. B	1¾	Dec. 1
Rochester Gas & Elec., pf. C and D	1¾	Dec. 1
Wisconsin Public Service, 6½% pf.	1¾	Dec. 1
Wisconsin Public Service, 7% pf.	1¾	Dec. 1

Manufacturing and Markets

Porcelain Manufacturers to Study Simplification

A representative group of manufacturers of porcelain insulators for electrical purposes convened at the Department of Commerce on Nov. 10, 1926, under the joint auspices of the National Committee on Metals Utilization and the Division of Simplified Practice, for the purpose of considering the feasibility of applying the principles of simplified practice to their product. Those who attended this conference represented approximately 70 per cent of the annual production of this commodity.

As presiding officer, Edwin W. Ely outlined the procedure that is followed by the Department of Commerce in its co-operation with business to eliminate prevalent avoidable waste, gave examples of successfully consummated simplified-practice programs, emphasized the difference between simplification and standardization, explained the advantage of providing a transitional period during which eliminated varieties may be cleared without infringement upon the effective date of a recommendation and indicated the willingness of the department to refer any tentative program which might eventually be proposed to a general conference of all interests in any way concerned with the fabrication, sale or use of the commodity under review for its consideration, modification and voluntary adoption. In contemplating what the scope of their first application of simplification to porcelain insulators should be, the following motion was proposed and unanimously adopted: "It is moved that those present at this meeting be appointed as a committee of the whole whose function it will be to conduct a survey of present conditions in the industry as a first step in the direction of achieving adequate standards." The conferees in following out the spirit of this motion at once constituted themselves a committee of the whole, with Jay R. Palmer of the Ohio Brass Company as chairman.

The survey that will be made will concern itself with the major production and demand of one-piece insulators. The results of such a study will not only provide a basis upon which to build a tentative simplified-practice recommendation, but they will add impetus to the work of standardization in this field, which was originally instituted in July, 1925, by the American Engineering Standards Committee. The simplified-practice committee has selected Dec. 15, 1926, as a tentative date when the chairman will institute a questionnaire for the attention of the manufacturers which will elicit the necessary information for further progress. The preparation of the initial draft of the recommendation will take cognizance of the needs of every concern engaged in the manufacture of porcelain insulators, and all such firms will be invited to submit their suggestions. In drafting the final tentative simplified practice recommendation, the manufacturers, distributors and representative users of this commodity will be convened in a general conference for the purpose of contributing their knowledge and experience.

Those present at the conference included W. F. Harvey, Porcelain Insulator Corporation, Lima, N. Y.; B. A. Plimpton and H. R. Noack, Locke Insulator Corporation, Baltimore, Md.; L. A. Lapp, Lapp Insulator Company, Inc., LeRoy, N. Y.; George I. Gilchrest, Westinghouse Electric & Manufacturing Company, Derry, Pa.; H. R. Holmes, R. Thomas Insulator Company, East Liverpool, Ohio; Jay R. Palmer, Ohio Brass Company, Mansfield, Ohio; C. E. Skinner, American Engineering Standards Committee, East Pittsburgh, Pa.; N. E. Way and Harrin Dexter, Electrical Division, Department of Commerce, and Edwin W. Ely and Joseph S. Crews, National Committee on Metals Utilization.

Production Statistics Urged

National Electrical Manufacturers' Association Appoints Committees —President Swope Urges Compilation of Statistics —Organization Perfected

THE recently formed National Electrical Manufacturers' Association is hard at work developing its organization and is now ready to follow out the purposes for which it was formed. The general plan is to have a unit organization of electrical manufacturers which will function in a way to better internal and external conditions in the electrical industry.

The first purposeful step taken was the sending of the following letter to manufacturing executives by President Gerard Swope of the N.E.M.A.:

"An essential requirement for successful management today is prompt and accurate information on available business and market conditions. The larger industries and companies, through their national organizations, have this to a greater extent than the smaller ones.

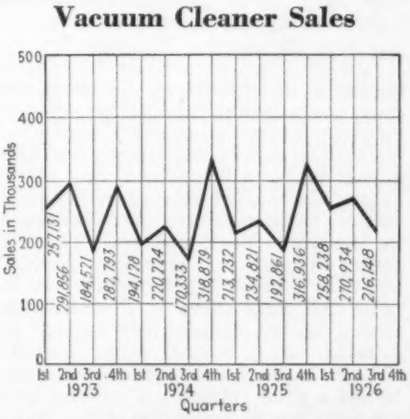
"One of the greatest advantages that the members of an industry can secure through national organization is the co-operation of each member in the compilation of this sort of data for the benefit of all. Many associations outside of the electrical industry are doing this, and their efforts have the approval and sanction of the Department of Commerce and have received the approval of the Supreme Court in opinions handed down in individual cases.

"It is the desire of the National Electrical Manufacturers' Association to provide statistics of this character for all sections of the industry where a majority of the members desire them. We wish to prosecute this work actively in relation to the products in which you are interested. It is intended to begin simply, by asking for monthly reports of shipments and stocks on hand, in the fewest classifications, to be supplied as soon as possible after the close of the month. As the members see its usefulness, this program can be modified or expanded.

"Data received from individual companies will be held confidential. No records will be kept of the figures submitted by the separate companies, and your reports will be returned to you with the consolidated totals of all companies. Copies of the consolidated totals, but no individual company's figures, will be given to members of the association, filed with the Department of Commerce and made available to other government departments, and to the public.

"This work is one of the greatest constructive advantages your association can give, and it is the hope of the officers that a large majority of the members will respond affirmatively. Will you please write me promptly (addressing your letter to the executive secretary, National Electrical Manufacturers' Association, 30 East Forty-second Street, New York) if you will furnish these monthly data for your company if a majority of those represented in your section agree to do so? Upon receipt of an affirmative reply from a majority, the work will be immediately undertaken. If you are a member of a section which is now compiling production statistics, won't you

Vacuum Cleaner Sales



Vacuum-cleaner sales by quarters during 1923, 1924 and 1925 and the first three quarters of 1926. (Data supplied by Vacuum Cleaner Manufacturers' Association.)

give me the benefit of your suggestions for further improvement and progress?"

COMMITTEES APPOINTED

As a second step in organization several committees have been appointed. These will work within their respective realms to represent the N.E.M.A., and several of them are already at work. The committee names and appointments are as follows:

Policy Committee—Members of executive committee with president as chairman.

Standards Committee—Supply Division: C. A. Bates, chairman, Bryant Electric Company, Bridgeport, Conn.; H. A. Calderwood, O. A. Fredericson, F. T. Wheeler. Apparatus Division: A. H. Moore, R. W. E. Moore, A. H. Timmerman, Alfred E. Waller.

Casualty and Fire Prevention Committee—Supply Division: D. H. Murphy, chairman, Wiremold Company, Hartford, Conn.; C. A. Bates, C. R. Boggs, H. R. Sargent. Apparatus Division: T. E. Barnum, A. H. Moore, R. W. E. Moore, H. C. Petty.

Finance Committee—H. B. Crouse, chairman, Crouse-Hinds Company, Syracuse, N. Y.; S. L. Nicholson, J. C. Belden, D. R. Bullen, W. R. McCanne.

Law Committee—C. H. Strawbridge, chairman, Goodman Manufacturing Company, Chicago; Clarence L. Collens, D. H. Murphy, C. W. Appleton, M. C. Rypinski, Harold Smith, Manton Davis, Francis E. Neagle, advisory counsel.

Membership Committee—Apparatus Division; F. S. Hunting, chairman, Robbins & Myers Company, Springfield, Ohio; A. L. Doremus. Policies Division: Shiras Morris, H. W. Young. Supply Division: J. F. Kerlin, P. G. Duryea.

Program Committee—Policies Division: General O. H. Falk, chairman, Allis-Chalmers Manufacturing Company, Milwaukee; J. H. Trumbull. Supply Division: H. D. Hawks, W. E. Sprackling. Apparatus Division: F. M. Kimball, James Burke.

The following committees are subcommittees of the policy committee:

Committee on Policy Relations with Other Organizations—Clarence L. Collens, chairman, Reliance Electric & Engineering Company; LeRoy Clark, D. R. Bullen, S. L. Nicholson, F. S. Hunting.

Committee on Department of Commerce—C. H. Strawbridge, chairman, Goodman Manufacturing Company, Chicago; David Sarnoff, J. McElroy, 3d, C. E. Skinner, C. H. Roth, R. J. Russell.

Committee on Underwriters' Laboratories—S. L. Nicholson, chairman, Westinghouse Electric & Manufacturing Company; T. E. Barnum, W. E. Sprackling, D. R. G. Palmer, H. R. Sargent.

Committee on Legislation—B. E. Salisbury, chairman, Pass & Seymour, Inc., Syracuse, N. Y.; L. A. Osborne, J. C. Hobart, L. B. F. Raycroft, Louis Allis.

Committee on Promotion of Codes, Statutes and Ordinances—S. L. Nicholson, chairman, Westinghouse Electric & Manufacturing Company; T. E. Barnum, C. A. Bates, B. B. Dinsmore, H. B. Kirkland, D. H. Murphy, D. R. Bullen.

Statistics Eliminate Waste, Says Hoover

In the section of his annual report dealing with progress in the elimination of waste Herbert Hoover, Secretary of Commerce, says that one of the largest sources of waste hitherto in our whole economic system has been the periodic booms and slumps of the "business cycle." "The waste of the boom through speculation," says the report, "overproduction, ill-advised expansions, extravagance, relaxed effort and decreased efficiency, with its inevitable collapse, is followed by still greater wastes during the depression by unemployment, and of all groups the farmer suffers the worst because of the inability of agriculture to readjust itself to new conditions, owing to a long period of turnover as compared to industry."

The report points out that as a contribution to greater stability the department has steadily enlarged its services of business statistics during the past five years, and while certain fundamental information can be collected only through government agencies, the policy of the department has been to encourage private and institutional action in every field where their success is possible. Secretary Hoover believes that we are rapidly approaching the time when a business man will be able to determine the exact position of his industry in relation to production, stocks, orders, sales, conditions of sources of supplies, the consuming market, credit, business activity and broad economic currents—both at home and abroad—which may influence the conduct of his particular occupation.

"Statistics are like weather reports in their relation to business conditions," the report says, "and they can be made to convey warnings of every incipient movement toward overproduction or inflation so that individual action becomes a great neutralizing force."

Business Conditions

SEVERAL negotiations under way and a number of new projects planned are reported by electrical men, although current sales are at a comparatively low figure. Central-station companies are inactive buyers, but industrial plants are placing a volume of business which is large in the aggregate. Preparations for the holiday season have brought about high merchandising activity throughout the country. The United States Steel Corporation last week reported an increase of 90,152 tons in its unfilled orders.

The National Industrial Conference Board, New York, in a survey of business and industrial conditions finds that: "Present business conditions are sound, and indications are that industrial and commercial activity on the whole will continue at a satisfactory momentum as far as the immediate future is concerned. "The outlook in the electrical apparatus and machinery industry," according to the board's analysis, "is very good, promising a continuation of a satisfactory volume of business for some time to come. The constant development of new industrial devices in all fields is continuing to bring in a steadily increasing amount of orders. The volume of orders for household and industrial electrical aparatus is steady and good, and the market for large apparatus, while showing a seasonal slackening reflecting the lighter buying by the utility companies during the fall season of the year, will, it is anticipated, be even better during the coming year than it has been during the past year."

In New England activity in sales of industrial equipment is declining, but many negotiations are under way for electrical power units, and a number of interesting orders for large turbo-generator units will probably be placed before the end of this year. Central-station companies are inactive buyers in the New York district. There is some demand for pole-line material, but that is much below normal. In the industrial field there is a decided increase in the demand for control apparatus, and motor sales continue strong. In the Southeast business maintained a good volume and several large projects are rumored. A large power company will soon enter the market for waterwheel generators, and good orders are reported from Mississippi and Louisiana. Increased activity is noted in the Middle West, and utility companies are busy with construction work and are making heavy purchases of maintenance material. Merchandising sales are at a high point in the St. Louis district. There are many requests for quotations on all kinds of electrical machinery, but buyers are slow in closing contracts. On the Pacific Coast a revival in power-company orders has been noted, railroad business is better and wiring sales are much improved. There is a continued lull in the movement of motors and heavier apparatus in the Seattle and Puget Sound districts, but several industrial projects are on the horizon.

Metal Sales Much Lower But Prices Slightly Firmer

The volume of sales of lead shows fewer ups and downs from week to week than does that of copper and zinc, and during the last week business has continued good, but copper and lead have sold in only about half the tonnage of the week before. Prices are very slightly higher in all three metals. The copper market seems to be well stabilized at the current level of 13¾ cents delivered in Connecticut and 14 cents at Middle Western points for all shipments from prompt to February. These prices have ruled throughout the week on most of the business, though some small lots have been released at 13.85 cents in the East and 13.95 cents at higher freight rate points.

NEW YORK METAL MARKET PRICES

	Nov. 10, 1926 Cents per Pound	Nov. 17, 1926 Cents per Pound
Copper electrolytic	13.85–13¾	13¾
Lead, Am. S. & R. price	8.00	8.00
Antimony	13	13
Nickel, ingot	35	35
Zinc spots	7.55–7.575	7.60
Tin, Straits	70¼	71¼
Aluminum, 99 per cent.	27	27

Base copper price Nov. 17, 1926, 16 cents.

Although there is no quotable change in the domestic markets for lead, a decidedly better tone has developed. Whereas a week ago sellers were quite anxious to dispose of their holdings at the prevailing quotations in New York, there appears to be less competition for the business, and at least one producer has raised his asking price to 8.10 cents delivered in New York. Sev-

eral small sales have been made at a premium of from 2½ to 5 points above the prevailing 8-cent quotation, but the tonnage is not sufficient to warrant recognition in the quotations. The American Smelting & Refining Company continues its official contract price at 8 cents New York. Zinc is fractionally stronger than it was last week, so far as price goes, as most producers are well sold out of current production and are not disposed to press sales. The volume of business, however, has been much less than last week. On Friday a good tonnage was sold to favorably situated consumers as low as 7.20 cents, St. Louis, for both November and December shipment, but most buyers have had to pay more, particularly since Monday. Spot Straits tin continues scarce, with prices about half a cent above those for prompt delivery. Consumers were in the market on Monday and have bought some today, but the market generally has been dull rather than active.

New England Market Quiet—Prospects Bright

Activity in sales of industrial equipment is declining throughout the New England district, but considerable attention is being given to negotiations for new electrical power units. Recently several orders for small turbo-generator sets were received by one manufacturer, and according to one firm a number of interesting orders for large units will be placed before the end of this year. Small-motor sales have fallen off in volume and during the past week have again slumped. Fractional sizes are in good demand and manufacturers of tools and appliances are negotiating for early deliveries. General supply trade, consisting of small switches, socket and wiring devices, wire and hardware, is steady and shows much improvement over that of last month.

Prospects for an encouraging trend in orders looms bright in view of a number of large new construction projects requiring electrical equipment and supplies, among which may be noted large baking and confectionery plants interested in industrial electrical heating, new additions to a number of machine-tool plants and changes in textile drives owing to the introduction of new weaving and knitting machinery. Household appliance sales are increasing and the jobbing trade in general is experiencing a pre-Christmas movement. Fancy fixtures are in good demand, range sales are strong, and table electric sets are selling well.

Increased Activity Noted in the Middle West

Evidence of good business is noticed throughout all sections of the Middle West. The volume is quite large and steadily increasing. Industrial activity continues and considerable business is being received from the railroads which plan sizable expenditures for rails and equipment. Increased activity in the coal-mining sections and in the steel industry is becoming more noticeable. The various utility companies are busy with construction work, and purchases of maintenance material have been quite heavy. Several large inquiries for paper-covered and lead-covered cables for 1927 requirements are out, and some purchasing of apparatus is being done. Among the interesting orders placed this week were one for several carloads of Western red cedar poles, circuit breakers valued at $25,000, 4,500 induction-type watt-hour meters, 750 direct-current watt-hour meters and a number of smaller orders for pole-line hardware. Jobbers' sales continue to hold up well. There has been a good demand for all appliances, with a particularly large demand noted for washing machines, one jobber placing a single order for 1,000 machines. Wiring devices, conduit, switches and wire are moving readily.

Sales to Utilities at Low Ebb in New York District

Sales to public utility companies in the New York district continue dull in all lines, and the amount of inquiries for quotations is reported to be small. The demand for generating equipment is very quiet, as it is also for large transformers and switching equipment. There is some demand for poles, crossarms and line hardware, but this is considerably below normal. In the industrial field there has been a decided increase in the demand for control apparatus this month, and motor sales continue strong, with an improvement in the sale of the larger-sized machines. One manufacturer reports a number of inquiries from refrigerating-machine makers for quotations on motors. Jobbers report a fair demand for household appliances.

Business Maintains Good Volume in Southeast

The general volume of business is holding up well in the Southeast, though there are few items worthy of particular mention. Several large projects requiring heavy investments in electrical apparatus are rumored, but no definite announcements of final plans are expected until later in the year or in the early part of 1927. One project of definite proportions is a two-million-dollar bond issue by one of the largest Florida cities, which provides for the expenditure of approximately $1,000,000 for turbo-generating equipment, boilers, condensers and accessories. One of the largest Southeastern power companies is engaged in the preparation of specifications for several waterwheel generators, on which bids will be requested shortly.

Central-station purchases continue satisfactory, one company placing orders for $30,000 worth of switching equipment and $13,000 worth of wire. Jobbers report a large number of small orders for wire, both weatherproof and bare. Pole-line materials are in good demand, one company placing orders aggregating $16,000 for these materials, and the number of small orders from the territory generally for conduit and lead-covered cable is quite satisfactory. Manufacturers say good business is coming from the states of Mississippi and Louisiana, one recent order being for seven 2,000-kva. transformers, and this is believed to presage orders for distribution materials in the near future. Jobbers report a well-sustained demand for appliances. Commercial lighting activities are to be noted in the larger centers, and a strong demand is reported for such lighting equipment as a result.

Merchandising Sales at High Point in St. Louis District

Merchandising sales have been at a high point in the St. Louis district. With the jobbers the Christmas business in all lines has probably reached the peak, and one of the largest houses reports that the holiday trade this year will be twice that of 1925. Several large orders for poles, wire and transmission-line hardware have been shipped to north Texas and Oklahoma. One contract, amounting to approximately $100,000, has been closed for outdoor transformers and switching equipment. This material goes to the coal fields of central Oklahoma. While this is the only order of considerable size reported, all manufacturers say that requests are coming in for quotations on all kinds of electrical machinery, but buyers are slow in closing contracts.

Power Companies Place More Orders on Pacific Coast

Reviving power company business on the Pacific Coast includes such items as one carload of 10-in. disk hook-type porcelain strain insulators, 5,000 guy clamps, 4,000 anchor rods, 15,000 lag screws and two carloads creosote for treating poles. Approximately ten carloads of creosote have been sold in the San Francisco district during 1926, each car being worth about $3,500. A street-lighting job, which will amount to about $70,000, is now being figured for the city of Berkeley, and railroad business is better and comprises many sizable items of miscellaneous lines. Line-material orders have included 750 poles, 5 in. x 9 in., 24 ft. to 30 ft. long, and 900 poles, 7 in. x 8 in., 20 ft. long. Wiring supply business is much improved, and several manufacturers report good sales to jobbers all along the Pacific Coast. Power apparatus and machinery orders include two synchronous converters for an electrochemical plant in Pittsburg, Cal., $20,000 worth of motors and control devices for a cement plant in the Yosemite Valley, an order for 25 assorted two-speed motors for an oil company, and a 300-kw. synchronous converter for an electric railway.

A continued lull in the movement of motors and heavier apparatus characterizes conditions in the Seattle and Puget Sound districts. Building construction is holding up well with every indication that last year's figures will be surpassed. Announcements were made in Seattle of two new commercial fireproof hotels, one fifteen and the other twelve stories high, and on which construction will start immediately. Industrial projects planned include doubling the capacity of a pulp plant at Anacortes, a new cement plant to be built on the South Fork of the Skykomish River, two large cold-storage plants in Yakima to cost $250,000 each and a pulp mill at Longview to cost about $2,500,000.

Activities of the Trade

Eureka Vacuum Contemplates Good Year

Sales of the Eureka Vacuum Cleaner Company for the current year are expected to be around $12,000,000, with resulting net profits, after taxes and charges, of close to $2,000,000. This would compare with sales of $10,090,151 and net of $1,626,602 last year. Unit sales are running at a record rate and are expected to range between 285,000 and 300,000 machines, against 246,825 machines last year. Production is running about 1,200 units a day. Sales in the Eastern territory have been especially good. All branches in the New York district have already exceeded their 1926 quota.

Fairbanks-Morse Show Increased Profits for Nine Months

C. H. Morse, president of Fairbanks, Morse & Company, Chicago, states that the preliminary accounts for the quarter ended Sept. 30 show net profits of $813,000 after depreciation and federal taxes. This compares with a net of $931,907 in the corresponding quarter of 1925. Net profits for the first nine months of the current year amounted to $2,446,000, compared with $2,209,646 for the first nine months of 1925.

Pacific Electric Manufacturing to Build Plant at St. Louis

Three acres of land on the Terminal Railroad Association Belt Line at St. Louis Avenue have just been purchased by the Pacific Electric Manufacturing Company, 5815 Third Street, San Francisco. The company will proceed at once with the construction of a factory building on the property from which it will supply the Middle West and East with oil circuit breakers and high-voltage switchgear.

The company has also opened an office at 419 Chemical Building, St. Louis, with F. H. Cole in charge. Mr. Cole, formerly electrical engineer of construction for the Texas Light & Power Company at Dallas, Tex., has also been appointed a vice-president of the Pacific company.

Large Order for Electric Coaches and Locomotives

The Pennsylvania Railroad has placed orders for 126 multiple-unit electric coaches to be used on the Southern Division main line between Philadelphia and Wilmington, Del., and the Octoraro branch between Philadelphia and West Chester, Pa. The new equipment is expected to be delivered by November, 1927. The Westinghouse Electric & Manufacturing Company is to build 93 of the new cars, the General Electric Company 30, and the Brown-Boveri Corporation five. The Pennsylvania Railroad has also placed orders for eight new electric locomotives with Westinghouse and General Electric, the equipment to be operated in the New York tunnel service. Delivery of the eight locomotives is expected to be made next September.

Maytag Company Balance Sheet

The balance sheet of the Maytag Company as of Sept. 30, 1926, showed current assets of $7,945,729, including $3,190,266 in cash and marketable securities. Current liabilities were $2,853,693, leaving net working capital of $5,092,026, compared with $4,456,945 on June 30 and $3,624,976 on Dec. 31, 1925.

Included in the current liabilities was a tax reserve of $927,983. After payment of dividends in the first nine months this year totaling $2,400,000, the balance of earnings carried to surplus for the period amounted to $2,422,000.

Engineering Equipment Firm Opens Oklahoma Office

F. T. Morrissey & Company, an electrical engineers' equipment company, has opened headquarters for Oklahoma at 1013 Braniff Building, Oklahoma City. This company handles engineers' equipment put out by the Esterline Angus Company, Kuhlman Electric Company, Jewel Electrical Investment Company and Truscon Steel Company. The company also has an office in Dallas, Tex. F. T. Morrissey is the head of this company. The local office will be in charge of H. T. Hudson, formerly of the Oklahoma Gas & Electric Company.

Allis-Chalmers Unfilled Orders Highest Since 1920

The quarterly earnings statement of the Allis-Chalmers Manufacturing Company for July, August and September shows billings of $7,811,854, compared with $7,298,571 for the same period last year. The net profits, after taxes, depreciation and reserves were deducted, were $925,662 and $826,107 for the same periods of 1926 and 1925 respectively.

The unfilled orders on hand as of Sept. 30, 1926, aggregated $13,323,324, contrasted with $10,147,072 at the commencement of the year, an increase of over 31 per cent. This is the largest amount of unfilled orders reported for any quarter since Dec. 31, 1920. Bookings of new business for the current nine months amounted to $25,670,191, compared with $21,491,989 for the same period a year ago, an increase of $4,179,202, or about 19½ per cent.

	1926		1925	
	Billing	Net Profit	Billing	Net Profit
July.....	$2,531,176	$299,348	$2,433,004	$289,296
August....	2,651,705	308,986	2,419,341	274,511
September.	2,628,971	317,327	2,446,225	262,299
	$7,811,853	$925,661	$7,298,570	$826,107

General Electric Company Reduces Transformer Prices

A reduction averaging 5 per cent in the prices of distribution and small power transformers rated at 500 kva. and less, 73,000 volts and below, and effective since Nov. 8, has been announced by the General Electric Company. The company states that this reduction is in line with its policy in giving the trade the benefit of economies resulting from improved engineering and manufacturing methods and quantity production. This is the fifth reduction that has been made by the General Electric Company on this class of material since 1920.

The Ingersoll-Rand Company, 11 Broadway, New York City, has been awarded a contract by the Golden Gate Ferry Company for three new Diesel-electric ferry boats to be added to its fleet in San Francisco Harbor. Three Ingersoll-Rand six-cylinder oil engines will be installed in each boat and each will be direct-connected to a Westinghouse generator and exciter.

The Ohio Brass Company, Mansfield, Ohio, manufacturer of electric railway equipment, etc., has completed plans for the erection of a new five-story and basement addition, 60 ft. x 250 ft. A portion of the structure will be used for office service.

The Adapti Company, Cleveland, manufacturer of "Adaptiboxes," flexible conduit fittings, vapor-proof fittings and conduit specialties, announces the opening of a New York office and warehouse at 112 East Twenty-third Street. The company has appointed Al Stone as district sales manager of this office. A complete stock of Adapti fittings will be kept on hand so that users in the Eastern territory may be enabled to make purchases from stock.

The Black & Decker Manufacturing Company, Towson, Md., manufacturer of electric tools, announces that C. M. Peter has been placed in complete charge of all export business of the company. S. D. Black, president of the company states that business generally in foreign countries has shown a gratifying increase this year with unusually bright prospects for a very substantial volume during the coming year.

The Moloney Electric Company, St. Louis, has appointed Almon Foster district manager in charge of sales for the New England district, with offices at 10 High Street, Boston. Mr. Foster has been actively engaged in merchandising electrical equipment in the New England district for more than thirty years and for a number of years past has represented the Moloney company in the capacity of distributing agent.

The Westinghouse Electric & Manufacturing Company recently opened a service shop at Fairmont, West Va., which will handle repairs on all electrical apparatus, particularly industrial and mine motors. It will be in charge of R. M. Bayle, service manager. This

shop has 8,000 sq.ft. of space, 3,200 sq.ft. of which is devoted to the shop proper. Among other facilities the equipment includes a banding lathe, a coil puller and a coil-winding machine, a 200-ton press, a commutator-slotting machine, an electric oven, 200-gal. dip tanks and a 10,000-volt test set.

The Graybar Electric Company announces that larger and more spacious quarters for the Detroit branch have been opened. The new building, 55 West Canfield Street, is a three-story concrete structure.

The Allis-Chalmers Manufacturing Company announces the apointment of Ernest Smith as sales engineer in the Oruro (Bolivia) office. This is a branch of the company's district office at Santiago, Chile.

The Ohio Brass Company, Mansfield, Ohio, announces the removal of its San Francisco office to Room 532 Matson Building. The company states that this change will better serve its customers and also will permit of better warehouse facilities.

The Square D Company, Detroit, manufacturer of electrical safety devices, announces the following changes in its sales staff: F. J. Holzhauer, who formerly had headquarters at Columbus, Ohio, has been made branch sales manager at Cincinnati, with offices at 309 Mercantile Library Building, and W. D. Clark, formerly in the Cincinnati territory has been transferred to the Pittsburgh office, 613 Bessemer Building. The company also announces that the location of Milwaukee office, under H. R. Allen, has been changed to Room 913, First Wisconsin National Bank Building.

The Hart-Parr Company, Charles City, Iowa, has opened an Eastern office in Pittsburgh with E. H. Foulke in charge. This office will handle the company's electric washing machine business, and Mr. Foulke will have full supervision of the sales organization east of the Mississippi River.

The Botfield Refractories Company, Philadelphia, manufacturer of "Adamant" fire brick and fire brick cement and refractory furnace linings, announces the appointment of the following distributors: The Westwater Supply Company, 150 North Third Street, Columbus, Ohio; the Klinger-Dills Company, 129 North Jefferson Street, Dayton, Ohio; the Coan Equipment Company, 236 Murray Street, Fort Wayne, Ind., and the Cleveland Tool & Supply Company, 1427 West Sixth Street, Cleveland.

The Link-Belt Company, 910 S. Michigan Avenue, Chicago, announces the opening of a new office with temporary quarters at 152 Temple Street, New Haven. R. H. Hagner, formerly of the Philadelphia office, will be the company's representative, who will devote his time especially to the sale of Link-Belt silent chain and roller chain.

The Benjamin Electric Manufacturing Company, 120 South Sangamon Street, Chicago, announces that J. H. Waterbury has joined its organization and will be in charge of its illuminating engineering department. Mr. Waterbury formerly served for a period of six years in the engineering department of the National Lamp Works of the General Electric Company at Cleveland.

The Dover Manufacturing Company, Dover, Ohio, announces that it is now offering a new line of table percolators and sets.

The Fay Company, 11 East Thirty-first Street, New York, is now offering a large electric rotary floor machine, "Jumbo" model, which weighs 125 lb. and is equipped with a ½-hp. motor.

The Falk Corporation, Milwaukee, announces that changes made in its Falk flexible coupling have resulted in improved production and reduced cost. The shell or cover is now made of pressed steel instead of cast steel and is bolted instead of having a screwed cover, and the hubs of the couplings are now drop forgings instead of rough forgings. The company states that the working principle of the present form of coupling remains exactly the same as in the former unit.

The Wiremold Company, Hartford, Conn., announces the development of a "Slick Finish Wireduct" loom which is clean to handle and which does not give off mica dust when it is being used.

The Simplex Wire & Cable Company, 201 Devonshire Street, Boston, announces the removal of its St. Augustine (Fla.) office to the Barnett National Bank Building, Jacksonville, Fla.

New Equipment Available

Air Filter

A new air filter which the manufacturer states has a number of outstanding advantages has been developed by the American Blower Company, Detroit. By means of this new filter, which is of dry plate design with hair-like tentacles for the arresting and retention of dust and dirt, dust-laden air is divided into a series of small jets which strike the flat filament-coated surface of the plates, dust and soot being projected against the filament, seized and retained. The air, changing its direction and rebounding from this surface, flows through to the next plate and is carried through ten successive dust-removal operations of this type. As dust builds up on these flat surfaces each preceding layer acts as a retentive member, the dust first attracted being itself the principal arresting and retaining factor for the succeeding particles. In this way the use of adhesives is avoided and the maximum load of a cleaner or filter is multiplied many times.

The outstanding advantages of this type of air filter are said by the manufacturer to be that it is impossible to clog the filter, that it does not require oil or other adhesives which have to be changed from time to time, that it has a constant effect and constant efficiency and that dust builds up on dust and does not get in the line of air flow.

Mica Insulation

A new mica insulation, known as "super-micanite," which is said to be a superior material, has been developed by the Mica Insulator Company, 68 Church Street, New York City. The development of a synthetic insulating cement, a resin produced from glycerine and phthalic anhydride, which possesses electrical and chemical characteristics particularly advantageous as a cement for mica insulating materials, has resulted in the further development of "super-micanite." This new insulation is said to be ideally adapted for commutator insulation work, for electric heating units and for high-tension work in general.

The outstanding advantages of "super-micanite" as compared with shellac-pasted mica are listed by the manufacturer as follows: It is non-corrosive to copper; its binder decomposes at high temperatures and then produces decomposition products which are neither corrosive nor conducting; it shows practically no slippage under pressure; its surface resistivity is approximately 350 per cent greater; it has higher dielectric strength; its loss factor is approximately 43.5 per cent of that of shellac-pasted mica; its volume resistivity is approximately 92 per cent higher; it has a greater resistance to moisture; it has more compressive strength than shellac-pasted mica up to 100 deg. C.; it has a lower moisture content and a greater transverse strength.

Time-Delay Attachment for Hand-Starting Compensators

A new time-delay attachment, announced by the General Electric Company, is designed for use with hand-starting compensators to provide undervoltage protection during brief disturbances in industrial power circuits. It can readily be mounted in the same supporting holes as used for the standard undervoltage release. Time delay is accomplished by a falling solenoid plunger whose downward movement is retarded through a rack by a flywheel. Upward movement of the plunger disengages the rack from the flywheel pinion, permitting an instantaneous movement. The time delay is about one and a half seconds, and if power returns in less than that time, the starting compensator is not tripped.

Pole-Type Capacitor

A new pole-type capacitor, in sizes ranging from 5 kva. to 120 kva. single-phase and 30 kva. to 120 kva. polyphase, has been introduced by the General Electric Company for improving power factor on distribution lines. These capacitors are especially intended to offset the increased proportion of reactive current resulting from the many new motor-driven appliances in use. The capacitors are inclosed in weatherproof casings and are fitted with standard hanging hooks so that they can be hung from a cross-arm in the same way as a transformer.

New Trade Literature

SUPERVISORY CONTROL.—A revised publication, C-1694-B, on supervisory control has been issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa. This publication contains a general discussion of supervisory control beginning with the installation at the property of the Cleveland Railways Company. It takes up the synchronous visual type of equipment, the code visual type and the audible type and also discusses the supervisory control protective equipment. Illustrations showing various types of the equipment are included.

SQUIRREL-CAGE MOTORS. — The Northwestern Manufacturing Company, Milwaukee, is distributing bulletin No. 111, covering its "type H-O" Hanson-Oesterlein self-starting squirrel cage motors. It contains a graphic representation of the current distribution during starting and running and also of speed torque curves of the type "H-O" and "HO-L" motors.

GRAPHIC METERS.—Bulletin No. 1,026 issued by the Esterline-Angus Company, Indianapolis, Ind., entitled "New Uses for Graphic Meters," discusses the use of graphic meters in automatic stations, recording hydraulic pressures in manufacturing plants, etc. Attention is also called to the use of Esterline-Angus instruments in radio-telegraph stations. Illustrations showing typical installations of the recorders and sections showing pressure records taken at a chart speed of 1½ in. per minute are included.

SWITCH.—A folder issued by Harvey Hubbell, Inc., Bridgeport, Conn., describes and illustrates the new Hubbell "Tip-Top" switch.

CONTROL EQUIPMENT.—Bulletin GEA-484 issued by the General Electric Company, Schenectady, N. Y., covers its new line of control equipment for charging storage batteries. It contains illustrations showing various types of the control equipment for generator and batteries. The company is distributing bulletin GEA-517 describing its type "CD" totally inclosed, fan-cooled, direct-current motors.

CONDULETS AND PLUG RECEPTACLES—The Crouse-Hinds Company, Syracuse, N. Y., is distributing bulletin No. 2,093, covering its type "MT" series of safety switch condulets. A folder issued by the company calls attention to its various types of plug receptacle condulets and safety switch condulets.

DISTRIBUTION TRANSFORMERS. — Leaflet No. 20,133-A issued by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., describes and illustrates types "SK" and "SKA" steel-clad distribution transformers.

PORTABLE ELEVATORS.—The Revolvator Company, 336 Garfield Avenue, Jersey City, N. J., has issued bulletin 90-A describing its model "R-H" hand-power, revolvable-base revolvator" for loading and unloading trucks or freight cars.

WATER COOLERS. — "Cooling Your Drinking Water Supply" is the title of a booklet issued by the Delco-Light Company, Dayton, Ohio, in which it describes the "Frigidaire" cooling unit for water coolers in factories, schools, hospitals, etc.

RECORDERS.—The Foxboro Company, Inc., Foxboro, Mass., has issued bulletin No. 114-1 describing the Foxboro-Heath CO_2 recorder. Illustrations showing the recorder and a reduced fac simile of a typical record produced by the CO_2 recorder are included.

DISTRIBUTION TRANSFORMERS. — Bulletin No. 2,060 issued by the Pittsburgh Transformer Company, Pittsburgh, describes and illustrates the Pittsburgh single-phase and polyphase distribution transformers.

ELECTRIC TRAMRAIL SYSTEM. — A circular issued by the Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Company, Wickliffe, Ohio, describes and illustrates the Cleveland electric tramrail system of hoisting and conveying loads for foundries, machine shops and other industrial plants.

CRANES AND EXCAVATING EQUIPMENT.—The Harnischfeger Corporation, Milwaukee, has issued bulletins Nos. 42-X and 61-X, describing the "P & H" corduroy cranes and excavating equipment.

ELECTRIC RANGES.—Catalog No. 302 issued by the Benjamin Electric Manufacturing Company, 120 Sangamon Street, Chicago, covers its new "Crysteel" electric ranges. Illustrations showing the various types of the ranges are given and a description of the construction of the "Crysteel" range is included. Attention is also called to a kitchen heater which can be attached to any of the electric ranges.

CEMENT. — The Botfield Refractories Company, Swanson and Clymer Streets, Philadelphia, is distributing a folder calling attention to the use of "Adamant" cement for furnace firebrick work.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

Sole agency is desired in Sydney, Australia (No. 22,973), for electrical equipment for automobiles.

An agency is desired in Melbourne, Australia (No. 22,935), for cigar lighters and flashlights.

An agency is desired in Montevideo, Uruguay (No. 22,959), for conductors, cables and other electrical supplies and bare and insulated copper wire.

An agency is desired in Milan, Italy (No. 22,984), for electric foundry furnaces.

An agency is desired in Mukden, China (No. 22,903), for generators and motors, electrical household devices and lighting fixtures, electric refrigerators and electrically operated pumps.

Purchase is desired in Flensburg, Germany (No. 22,982), of electrical household appliances, especially cooking and heating articles, and installation material.

An agency is desired in Shanghai, China (No. 22,983), for radio sets and parts.

Purchase is desired in Copenhagen, Denmark (No. 22,981), of radio supersets and parts and ebonite battery boxes.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

MILLBURY, MASS.—The Felters Company plans to install electric power equipment in the proposed addition at its plant, to cost about $175,000.

NORWICH, CONN. — The Eastern Connecticut Power Company has petitioned the City Council for permission to extend its transmission line along the old Canterbury turnpike, a distance of 8/10 of a mile.

Middle Atlantic States

BROOKLYN, N. Y. — The Brooklyn Edison Company has plans under way for extensions and improvements in its equipment storage and distributing plant at 129-30 Third Avenue, to cost about $25,000.

EAST VIEW, N. Y.—Extension to the lighting district at East View is under consideration by the Town Boards of East View, Greenburgh and Mount Pleasant. It is planned to light several roads now without street lamps. The Westchester Lighting Company, Mount Vernon, furnishes street-lighting service in this district.

HEMPSTEAD, N. Y.—The installation of an ornamental lighting system in the business section is under consideration by the Village Board.

KINGSTON, N. Y.—Steps have been taken by the Downtown Business Men's Association to secure additional lamps for three business streets.

MOUNT MORRIS, N. Y.—Plans of the Rochester Gas & Electric Company for the construction of a storage reservoir in the Genesee River at Mount Morris, to cost about $10,000,000, have been approved by the New York State Engineering Department. The dam is to be built by the Mount Morris Light & Power Company. Work will not begin on this dam until the Caneadea dam, now under construction, farther up the valley is completed.

NEW YORK, N. Y.—Bids will be received by the Commissioner of Purchase, Room 723, Municipal Building, until Nov. 23 for furnishing X-ray and electrical equipment to the Department of Public Welfare.

NEW YORK, N. Y.—Bids will be received by the Department of Public Welfare, Tenth Floor, Municipal Building, until Nov. 23 for furnishing and installing electric work, contract No. 4, but not lighting fixtures for the Bronx General Hospital. Bids will also be received at the same time and place for the erection and equipment of an emergency pumping station, including electric transmission line from the power house, for the Sea View Hospital, borough of Richmond. Charles B. Meyers, 31 Union Square West, is architect.

NORTH TONAWANDA, N. Y. — The Board of Aldermen has authorized the installation of ornamental lamps on Grand Avenue, between Hill Street and Elmwood Park.

OSSINING, N. Y.—Bids will be received by James L. Long, superintendent of state prisons, Capitol, Albany, until Nov. 30, for construction, heating, sanitary and electric work of administration building, assembly hall, cell blocks "A" and "B," and connecting corridors at Sing Sing Prison. Bids will also be received at the same time and place for refrigeration work, additional ammonia compressor and motor for Sing Sing Prison.

WHITESBORO, N. Y.—Residents living along the Syracuse line have petitioned the Town Board for the establishment of a lighting system.

YONKERS, N. Y. — The Lackawanna Dock & Lighterage Company, Buffalo, plans to install electric power equipment at its proposed local drydock and shipyard. The entire project will cost about $500,000.

ORANGE, N. J.—The Business Men's Association of Orange and East Orange have petioned the Orange Commission and the Council of East Orange for an improved lighting system on Main Street from the West Orange line through Orange and East Orange to the Newark line.

RAHWAY, N. J.—Extension to the street-lighting system early in 1927 is under consideration by the Village Board.

RUTHERFORD, N. J.—Application has been made to the Council for extension to the ornamental lighting system on Park Avenue, covering a distance of about 1 mile.

BETHEL, PA.—The Metropolitan Edison Company, Reading, which has acquired the plant of the Blue Mountain Electric Company contemplates extensions in transmission lines in Bethel, Strausstown, Jonestown and vicinity, now served by the Blue Mountain company.

BETHLEHEM, PA.—Preliminary plans have been approved by the board of trustees of Lehigh University, for an electrical and mechanical building at the institution, to include laboratories, shops, electrical testing departments, etc., to cost $1,000,000. Visscher & Burley, 51 East Forty-second Street, New York, are architects.

ELLWOOD, PA.—The City Council has authorized the installation of an ornamental lighting system on Sixth Street from the railroad crossing to Crescent Avenue.

McDONALD, PA.—Plans have been filed by the McDonald Ice Company for an ice plant, to cost about $80,000.

PHILADELPHIA, PA.—Bids will be received by the Department of City Transit, 1211 Chestnut Street, until Nov. 23, for construction of two substations, one to be located on Louden Street, near Broad Street, and the other on Cumberland Street. These substations will supply current for operating trains for the Broad Street subway, now under construction.

WARREN, PA.—The Conewango Refining Company plans to install electric power equipment in connection with proposed extensions and improvements in its oil refinery, to cost about $350,000.

AMCELLE, MD.—The American Cellulose & Chemical Manufacturing Company plans to install electric power equipment in a proposed new addition, to cost about $200,000. Amcelle has not a post office.

BALTIMORE, MD. — The Consolidated Gas, Electric Light & Power Company of Baltimore has applied for permission to erect a transmission line from a point about a mile from Churchville to a point southeast of Earlton, covering a distance of about 6 miles.

LAUREL, MD.—Commissioners of the District of Columbia, District Building, Washington, D. C., have rejected all bids submitted for the construction of a power plant at the local District Training School. New bids, it is understood, will soon be asked for.

RELEE, VA.—The West Brothers Brick Company, 719 Fifteenth Street, N. W., Washington, D. C., contemplates the in-

stallation of electric power equipment in connection with the rebuilding of its local plant, to cost about $200,000.

WASHINGTON, D. C.—Bids will be received by the Chief of Engineers, United States Army, Washington, until Dec. 9, for one Diesel engine generating set, with switchboard and accessories.

WASHINGTON, D. C.—Bids will be received by the General Purchasing Officer, Panama Canal, Washington, until Nov. 26, for cable, telephone cords, receiver cords, motors, fans, switches, etc. (Panama Circular 1767).

WASHINGTON, D. C.—The immediate installation of beacon lights, boundary lights, obstacle lights and other aids to air navigation on the emergency landing fields along the air mail line of the National Air Transport between Dallas and Chicago has been ordered by the Department of Commerce.

North Central States

CAMP CUSTER, MICH.—Bids will be received by the United States Veterans Bureau, Arlington Building, Washington, D. C., until Nov. 30, for installation of a refrigerating plant at the United States Veterans Hospital 100, at Camp Custer.

COLUMBUS, OHIO. — The Teachourt Sash & Door Company plans to install electric power equipment in connection with the rebuilding of its mill, recently damaged by fire, with a loss of about $300,000.

PORTAGE, OHIO.—The installation of an ornamental lighting system in the business section is under consideration.

TOLEDO, OHIO.—Bonds to the amount of $3,000,000 have been voted for building to house police and fire-alarm telegraph apparatus.

HARRODSBURG KY. — The Kentucky Utilities Company, Louisville, which has been granted a local franchise, is planning to extend its transmission line in this section.

LOUISVILLE, KY.—The Board of Public Works has authorized the installation of an ornamental lighting system in the business district.

PERU, IND.—The City Council has authorized the construction of an addition to the municipal electric light and power plant. New equipment will be installed.

AURORA, ILL.—Preparations are being made by the Public Service Company of Northern Illinois, Chicago, for extension to its transmission system in connection with the furnishing of electricity to the Chicago, Aurora & Elgin Railroad Company. The work will include the erection of a second circuit on the 132,000-volt, steel tower transmission line in the Skokie Valley from Waukegon to Evanston, construction of new substations, etc.

CHICAGO, ILL.—A. Brandwein & Company, 2335-43 South State Street, plans to install electric power equipment in its proposed mattress factory on Wentworth Avenue, to cost about $250,000.

CLINTON, ILL.—Plans have been prepared for widening, remodeling lighting system and extending water mains, approximately twenty-five blocks on various streets in the city, to cost about $85,000. Warren & Van Praag, Inc., Milliken Building, Decatur, is engineer.

EVANSTON, ILL.—The City Council has engaged Randolph Perkins & Company, engineers, 33 South Clark Street, Chicago, to design and lay out an ornamental street lighting system in business and residential sections, to cost about $1,250,000.

EMBARRASS, WIS. — The Wisconsin Power & Light Company, Madison, is considering the construction of a power plant on the Embarrass River, at this place.

FLORENCE, WIS.—The City Council is considering a bond issue of $10,000 for extensions in the municipal lighting system.

FORT ATKINSON, WIS.—The Wisconsin Gas & Electric Company, which has acquired the municipal gas and electric plant, plans extensions to its transmission lines in this district.

MILWAUKEE, WIS.—Plans are under way for the installation of an arch street-lighting system, in the uptown district during the holiday season, to cost about $5,000.

ST. PAUL, MINN.—The City Council has authorized the installation of ornamental lamps on West Seventh Street, from Tuscarora Avenue to the Fort Snelling bridge, and on Van Buren Street from Hamline to Snelling Avenue. G. M. Shepard is city engineer.

EMMETTSBURG, IOWA.—The establishment of a municipal electric light plant is under consideration by the City Council.

KANSAS CITY, MO.—The Hinde & Dauche Paper Company, Sandusky, Ohio, is planning to install electric power equipment in a proposed local fiber board mill, to cost about $1,000,000.

MANCHESTER, MO.—Plans are under way by the St. Louis Ice & Cold Storage Company, for the construction of a new cold storage and refrigerating plant, to cost about $45,000. H. G. Clymer, Wainwright Building, St. Louis, is engineer.

MOBERLY, MO.—The Missouri Light & Power Company has submitted a proposal to the City Council offering to remodel the street-lighting system, changing all of the street lamps to incandescent lamps, and also to erect a lamp on every street corner in the city.

ST. LOUIS, MO.—Bids will soon be asked by the Board of Public Service, for the construction of an electrical and mechanical service and repair building, including meter and testing divisions, etc., at Twelfth and Clark Avenues, to cost $1,000,000. Study & Farrar, Arcade Building, are architects.

WALDO, MO.—Plans are being prepared by the City Ice Company, Twenty-first and Campbell Streets, Kansas City, for a local ice plant, to have a daily capacity of 80 tons.

CEDAR RAPIDS, NEB.—Extensions are being made to the plant of the Van Ackern Brothers to increase the output of the power station to 1,000 hp.

CRETE, NEB.—At an election held recently the proposal to establish a municipal electric plant was approved by the taxpayers.

CROFTON, NEB.—The Western States Utilities Company, Lincoln, recently organized plans to erect a transmission line from Hartington to Crofton, to furnish electrical service here.

GRAINTON, NEB.—The City Council is considering a proposal for the erection of a transmission line from Wallace, for local electric service.

NEBRASKA CITY, NEB.—The budget of the Water & Light Company of Nebraska City for 1927, provides for an expenditure of $100,000 for extensions and improvements in its system.

SCRIBNER, NEB.—The Elkhorn Valley Power Company, successor to the Scribner Artificial Ice Company, plans to enlarge the electric plant and also to extend its transmission lines.

Southern States

SUMTER, S. C. — The Yadkin River Power Company, Raleigh, which recently acquired the plant of the Sumter Power & Ice Company, plans to extend its transmission line in this section.

CORDELLE, GA.—Bonds to the amount of $1,250,000 have been authorized by the voters of Crisp County toward the construction of a hydro-electric plant on the Flint River in Crisp County, near Cordelle. The plans provide for a development of 14,000 hp.

MIDVILLE, GA.—The Georgia Southern Power Company, Dublin, has acquired the local distribution system and will extend its high-tension transmission line to Midvale to furnish electricity here.

SAVANNAH, GA.—The Savannah Electric & Power Company has applied for permission to build a substation at Thunderbolt.

SWAINSBORO, GA.—The Georgia Southern Power Company, Dublin, plans to erect a transmission line from Louisville to Swainsboro, about 30 miles.

BELLEVIEW, FLA.—The Florida Power & Light Company, Miami, which has acquired the plant of the Belleview Utilities Company, has been granted a thirty-year franchise and plans to erect an 11,000-volt transmission line from Chandler to furnish service here.

BONITA SPRINGS, FLA.—Plans are under consideration by the Florida Power & Light Company, Miami, for the installation of a new electric power plant at Bonita Springs. A new icing platform will also be erected.

CENTER HILL, FLA. — The Florida Power & Light Company, Miami, which has acquired the local electric plant, plans to rebuild the local distribution system and reconstruct a 14-mile transmission line.

JACKSONVILLE, FLA.—Plans are being prepared by the Scofield Engineering Company, Commercial Trust Building, Philadelphia, for extensions to the municipal electric system, for which $2,000,000 in bonds were recently authorized.

LEESBURG, FLA.—Application has been made to the City Commission by J. D. Young, of the Oklawaha Power Company for permission to lease part or all of the municipal public utilities. An additional generating unit consisting of a 700-hp. turbine and a 600-kva.-generator, will be installed at the Oklawaha Reclamation Farms.

ST. PETERSBURG, FLA.—The Pinellas County Power Company is planning extensions in transmission lines in this vicinity.

TAMPA, FLA.—Plans are under way by the Florida Portland Cement Company for the construction of a new mill in the Hocker's Point section, to cost about $1,000,000. The plans provide for a power house, machine shop, etc.

RIPLEY, TENN.—The municipal electric, water and ice plant has been acquired by interests connected with the National Power & Light Company, 71 Broadway, New York City. The installation of an ornamental lighting system, consisting of about sixty standards is under consideration by the City Council.

BILOXI, MISS.—The installation of electric generating equipment and also extensions to its ice-manufacturing plant is under consideration by the Peoples Ice Company.

GADSDEN, ALA.—Plans are under consideration by the Alabama Power Company, Birmingham, for the erection of a transmission line from East Gadsden toward Hokes Bluff, and also from Ragland to Asheville.

HOMINY, OKLA.—The City Council contemplates the installation of an ornamental lighting system on Main Street.

LAWTON, OKLA.—Plans are being prepared by the Southwestern Light & Power Company for a local ice plant of 100 tons capacity, to cost about $175,000.

SHAWNEE, OKLA.—Bids will be received by the City Commissioners until Dec. 3 for the installation of an ornamental lighting system.

HUMBLE, TEX.—The Houston (Tex.) Light & Power Company has acquired the power plant of the Humble Power & Ice Company, and will furnish local service from the high-tension line, which will be extended from its power station on the Ship Channel.

LEEDY, TEX.—Preliminary plans have been prepared by the Southwestern Light & Power Company, Braniff Building, Oklahoma City, for the erection of a 23,000-volt transmission line from Leedy to Shattuck, 25 miles long, to cost about $50,000.

PLANO, TEX.—The Texas Power & Light Company, Dallas, plans to build a local substation, to cost $50,000.

SAN BENITO, TEX.—Surveys are being made by the Rio Grande Valley Gas Company, care J. B. Gaines, for refrigerating and pre-cooling plants at various points in the lower Rio Grande Valley.

Pacific and Mountain States

OLYMPIA, WASH.—The Olympia Pulp & Paper Company, plans to install electric power equipment in its proposed local mill, to cost about $500,000. Lester W. David, 906 North Seventy-fourth Street, Seattle, is manager.

SEATTLE, WASH.—Plans prepared by F. R. Nicholas, special Skagit engineer, working under the direction of J. D. Ross, superintendent of the Municipal Lighting Department, for a second dam at Diable Canyon in connection with the Skagit River hydro-electric project, have been accepted by the Board of Public Works. The proposed dam will provide 100,000 acre-ft. of water storage space. On completion of the dam a power plant will be built, equipped with two 37,500-hp. turbines, etc. The plant will be located about 125 miles from Seattle, and will cost about $2,689,500. The cost of the entire project including railroad, dam, equipment, etc., is estimated at $6,010,500.

EAGLE ROCK, CAL.—Residents in the district north of Colorado Boulevard and east of Ellenwood have petitioned for the installation of ornamental street lamps in that section.

LONG BEACH, CAL.—The City Council has authorized the installation of an ornamental lighting system on the Ocean Boulevard, between American and Golden Avenues, using metal standards.

LOS ANGELES, CAL.—Plans have been prepared by L. H. Hibbard, Metropolitan Building, for hospital and nurses' home for the Childrens Hospital Association, including elevators, refrigerating system, steam

heating system, etc., at Sunset Boulevard and Vermont Avenue, to cost about $500,000.

LOS ANGELES, CAL.—The City Council has adopted ordinances, providing for the installation of ornamental lamps on Western Boulevard, Alma, Meyler and Leland Streets, and on Thirty-eighth Place, using concrete standards; also on the York Boulevard, using pressed steel standards.

RIVERSIDE, CAL.—Permission has been granted the Nevada-California Power Company to construct a hydro-electric plant on Leevining Creek in Mono County, to develop 20,000 hp. The cost of the project with transmission system, is estimated at $1,000,000.

SAN FRANCISCO, CAL.—The American River Hydro-Electric Company, care of S. E. Kieffer, 57 Post Street, has applied for permission to build a hydro-electric plant on the American River in Sacramento County, to develop 45,000 hp. The cost of project with transmission system, is estimated at $7,000,000.

SAN JACINTO, CAL.—The City Council has authorized the installation of ornamental lamps on Central and San Jacinto Avenues and Main Street, between Estudillo and Jordon Avenues.

SAN JOSE, CAL.—The City Council has authorized the installation of ornamental lamps on First Street, between the Southern Pacific right-of-way and Rose Street, using cast iron standards.

GLENDALE, ARIZ.—Bids will be received by the City Council, until Nov. 26, for the installation of an ornamental lighting system in the business district.

PHOENIX, ARIZ.—Plans are under consideration by the Roosevelt Irrigation District, Ellis Building, to erect transmission lines in connection with a proposed new irrigation project, to cost $2,500,000, for which bonds have been voted. The C. H. Loveland Company, Balboa Building, San Francisco, is consulting engineer.

PHOENIX, ARIZ.—The Salt River Valley Water Users' Association has entered into a contract with the Nevada Consolidated Mining Company, Ely, Nev., whereby it will furnish hydro-electric power to the latter. A transmission line will be erected from Superior to Ray, a distance of about 15 miles, to connect with the transmission system of the Salt River Valley Water Users' Association.

GLASGOW, MONT.—The Montana Power Company, Butte, plans to build a local substation, to cost about $30,000.

DENVER, COL.—The installation of an ornamental lighting system on Arapahoe Street, covering a distance of about 1 mile, is under consideration by the Arapahoe Street Improvement Association.

DENVER, COL.—Bids will be received by the Bureau of Reclamation, Denver, until Nov. 29, for furnishing two switching towers for the Guernsey power plant, North Platte project, Nebraska-Wyoming, and for the Minidoka power plant, Minidoka project, Idaho. Also, until Nov. 26, for geared gate hoists and cast-iron gates for the Grand Valley project, Col., and the Klamath project, Oregon-California.

CLOVIS, N. M.—The New Mexico Power Company, Santa Fe, which is building a hydro-electric plant at Clovis, will expend about $100,000 for various equipment for the plant.

SILVER CITY, N. M.—Improvements are being made to the plant of the Silver City Electric Power Company including the installation of a 600-hp. engine. to cost about $150,000.

Canada

VANCOUVER, B. C.—Plans are under way by the British Columbia Electric Railway Company for developing the water power of Bridge River. The plans for an initial development of 50,000 hp. to cost about $12,000,000, with an ultimate expenditure of $38,000,000 during the next five years. The company plans to supply power for the Pacific Coast end of the Canadian Pacific Railway, which is to be equipped for electrical operation.

KIRKLAND LAKE, ONT.—Surveys have been made by the Canada Northern Power Corporation for the erection of a second transmission line from its Indian Chutes plant in the Fort Matchewan district to Kirkland Lake.

MONTREAL, QUE.—The Canadian International Paper Company is preparing plans for the construction of a hydro-electric power plant on the Red River, in the vicinity of Mountain Falls, to cost about $1,000,000, with transmission system.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 19, 1926)

1,603,271. ELECTRIC REGULATOR; R. Davies, Fort Wayne, Ind. App. filed June 20, 1924. Wherein a swinging contact is arranged to engage successively a series of contacts connected into a resistance coil for regulating the voltage of electric current for various purposes.

1,603,279. SPARK ARRESTER; F. Gray, New York, N. Y. App. filed Dec. 1, 1922. Means for preventing sparking at relay or like contacts. A short spark gap or valve formed of two simple punchings inclosed in a glass tube containing an easily ionized gas at a low pressure.

1,603,283. ELECTRICAL COMPENSATOR; F. A. Hubbard, West Englewood, N. J. App. filed Jan. 4, 1921. For use in a system for determining the direction of propagation of wave energy.

1,603,289. SWITCHING DEVICE; H. W. O'Neill, Brooklyn, N. Y. App. filed May 4, 1922. For use in telephone or telegraph systems. A device which, when associated with a first and second circuit, operates in response to interrupted vibrations through the first circuit to control the second circuit; to control a plurality of circuits by a common vibrating element.

1,603,291. BATTERY ELECTRODE; D. Pepper, Philadelphia, Pa. App. filed July 30, 1924. A method of forming an electrode from preformed active lead material and in which the active material will be of desirable consistency with regard to hardness and porosity; will have a high degree of electric conductivity; will be free from a tendency to distintegration and will retain these qualities on repeated charge and discharge.

1,603,339. SYSTEM FOR UNIPOLAR HIGH-FREQUENCY TREATMENT; H. Herrmann, Berlin, Germany. App. filed May 26, 1924. Electric therapeutic apparatus.

1,603,416. MAGNETIC COIL; W. J. Shackelton, Scotch Plains, N. J. App. filed May 4, 1922. Low-voltage transformer. One form comprises a substantially hemispherical or cup-shaped casing having in its top a small centrally disposed opening closed by an insulating plug through which pass the various connecting wires for the transformer windings. A terminal plate, on which are mounted the junctions of the connecting wires to the transformer leads, is supported from the plug and in turn supports the transformer windings and core. The plug and the terminal plate constitute clamping means for holding the transformer windings tightly in place against the upper part of the casing. The bottom of the casing may be closed by a suitable metallic base.

1,603,417. ELECTRIC GAS LAMP WITH GLOW DISCHARGE; O. Schaller, Sudende, near Berlin, and F. Schroter, Schnargendorf, near Berlin, Germany. App. filed Nov. 22, 1920. Adapted to be operated at the voltages common in the usual electric supply systems.

1,603,420. ELECTRIC GAS-FILLED LAMP WITH GLOW DISCHARGE; F. Schroter, Berlin, Germany. App. filed Jan. 3, 1920.

1,603,425. ELECTRIC WATER HEATER; E. C. Steere, Sydney, New South Wales, Australia. App. filed April 24, 1925. Provided with a lid and of the type in which the water is heated by an immersed heating element. The lid is adapted to be locked in closed position by the act of attaching the connecting plug to the contact points of the heating element and is retained in that position as long as the plug remains on the points.

1,603,440. IRON CORE IN ELECTRICITY METERS; J. Zuger, Zug, Switzerland. App. filed May 26, 1924. An iron core for an electrical meter, having a lateral extension on either side, each extension comprising a laminated iron block, adjustably mounted on the pressure core.

1,603,443. ELECTRIC STORAGE CELL; R. C. Benner, Bayside, N. Y. App. filed Jan. 13, 1923. Adapted for the operation of hand lamps or the like.

*Some of the patents issued Oct. 26 appeared in the issue of Nov. 13 prior to those issued Oct. 19. The patents issued Oct. 19 appear complete in this issue. The patents issued Oct. 26 which did not appear in the issue of Nov. 13 owing to lack of space will be found in next week's issue.

1,603,459. WIRE HANGER; A. J. Gurney, Canton, Ohio. App. filed Jan. 13, 1925. For suspending a trolley wire as well as one or more feed wires and wherein the feed wire or wires will be mechanically and electrically connected with the trolley wire at each hanger so that should the trolley wire break current will be supplied across the gap therein through the feed wire or wires, thus allowing the continued operation of the trolley car or locomotive by coasting across the gap in the trolley wire.

1,603,497. MAGNETIC CHUCK WITH FINE-MESH FACEPLATE; F. L. Simmons, Woonsocket, R. I. App. filed June 25, 1924.

1,603,517. SAFETY DEVICE; E. R. Christensen, Los Angeles, Cal. App. filed July 2, 1925. A ground connection adapted to be drawn over the wires of a high-voltage line for electrical contact therewith, so that if the circuit through the high-voltage line is accidentally closed the current will be grounded before reaching a lineman working on the wires; to provide means for drawing the ground connection over the electric line so as to prevent accidental disengagement of the ground wire from the hauling means, and which will afford leverage for drawing the ground connection taut with little effort and minimum strain upon the wires of the electric line.

1,603,523. HANDLE-CONTROLLED SWITCH; H. A. Douglas, Bronson, Mich. App. filed June 18, 1926. Means for assembling the hub portion of such a handle with the casing.

1,603,554. SERVICE SWITCH; J. H. Pengilly, Los Angeles, Cal. App. filed March 26, 1925. Having a switch arrangement which is so designed that circuit wires will not interfere with the operation thereof; a switch which is positioned to the side of the fuse block and which has a knife contact swingable in a plane parallel to the front of the box.

1,603,575. TROLLEY HARP; A. H. Becker, Baltimore, Md. App. filed June 13, 1924. Adapted for use with overhead wires in electric railway systems.

1,603,580. METER-SEALING MEANS; S. Cahill, Jr., New Orleans, La. App. filed March 13, 1924. In combination with a meter having a stationary housing section, a removable housing section and a bolt extending from the stationary section through an opening in the removable section for holding the latter in place; a sealing member of said opening surrounding said bolt and bearing against the inner side of said removable section, and a hard sealing ring interposed between the two housing sections, said sealing member and sealing ring preventing the insertion of a wire or instrument to throw the meter out of play.

1,603,646. ELECTRICAL TRANSMISSION SYSTEM; E. A. Sperry, Jr., Brooklyn, N. Y. App. filed July 21, 1920. For positioning an indicator or other device in accordance with the position of a remotely located element.

1,603,670. SURGICAL BAKER; W. S. Edmands, Boston, Mass. App. filed Aug. 3, 1925.

1,603,679, 1,603,680, 1,603,681, 1,603,682. ELECTRICAL CONNECTOR; W. J. Gagnon, Bridgeport, Conn. Apps. filed Sept. 17 and Oct. 8, 9 and 14, 1925. Adapted for use with appliances.

1,603,720. MOUNTING FOR ROTATIVE MAGNETIC CHUCKS; F. L. Simmons, Woonsocket, R. I. App. filed Aug. 23, 1922. When used to support work being wet-ground, and more especially for a mounting for a rotary magnetic chuck wherein the electrical connections are protected from being short-circuited by the grinding fluid.

1,603,789. HIGH-POTENTIAL ELECTRICAL SYSTEM; M. Morrison, Oak Park, Ill. App. filed July 23, 1920. Applicable to X-ray apparatus.

1,603,801. COIL-WINDING MACHINE; W. H. Potter, Chicago, Ill. App. filed Dec. 27, 1923. Machine for winding strand material on ring-shaped objects, especially toroidal coils.

1,603,807. APPARATUS FOR RESISTANCE WELDING SHEET-METAL ARTICLES AND THE LIKE; C. Schaer, Langenthal, Switzerland. App. filed April 29, 1924.

1,603,820. APPARATUS FOR SURPRESSING ARCS; H. N. Wade, Shorewood, Wis. App. filed April 11, 1921. For suppressing arcs in air formed incident to operation of electric circuit controllers.

1,603,830. LIGHTING AND POWER SYSTEM; W. L. Bliss, Niagara Falls, N. Y. App. filed June 25, 1910. Automatic switch-control mechanism for farm-lighting plants and which is adapted to connect the dynamo-electric machine either in starting relationship to the battery or in energy supply relationship to the battery and load circuits.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Niagara Equivalent Added Twice Over in Less than Half a Decade

PARALLELING the constantly increasing electrical energy output, but by no means keeping pace with it, recent years have brought with them a notable increase in the installed capacity in hydro-electric plants. Figures bringing this information up to the spring of 1926 have recently been published by the United States Geological Survey. According to that authority, the present installed capacity is equivalent to about one-third of the potential power available 90 per cent of the time and about one-fifth of the power available 50 per cent of the time, these two figures being respectively 34,818,000 and 55,030,000 horsepower.

Several facts emerge from these statistics. One of them is the increasing use of central station energy in manufacturing. In the fall of 1921, 21.7 per cent of the total horsepower was to be found in industrial plants. Two and one-half years later the ratio had fallen to 19.1 per cent. The next year it was 17.4 and in 1926 17.1 per cent. Meanwhile the total, composed of public utility and municipal as well as manufacturing plants, had increased 41 per cent. Or, putting the comparison in slightly different form, while the central-station installations increased by 49 per cent, those in the manufacturing plants increased by but 11 per cent.

Another significant fact is the geographical distribution of the new developments. Both numerically and in terms of percentage the Pacific Coast States have predominated in this respect. Next in magnitude come the South Atlantic and the East South Central States, each of which group shows a gain of 400,000 hp. in the past two years.

The small increase in New England is significant. The fact is that New England's present installation already exceeds, by a half, the water power available 90 per cent of the time, and amounts to practically three-fourths of the power available 50 per cent of the time.

In somewhat less degree the same remarks apply to the East North Central division, in which the installed capacity exceeds by a third the power available 90 per cent of the time. In these two sections the process of hydraulic development appears to be well along toward completion. There is of course still the possibility of new installations to the extent of hundreds of thousands of horsepower, but the most promising sites have evidently been developed.

Clearly the future for water-power development in this country lies in the Southern Appalachian and in the Far Western States. In the former the horsepower installed can probably be doubled or more than doubled before the economic limit is reached, while in the Pacific and Mountain States a many-fold increase is bound to take place as the needs of the region justify the investment. While these latter now contain about a third of our total developed water power, they contain two-thirds of what is available in the country as a whole.

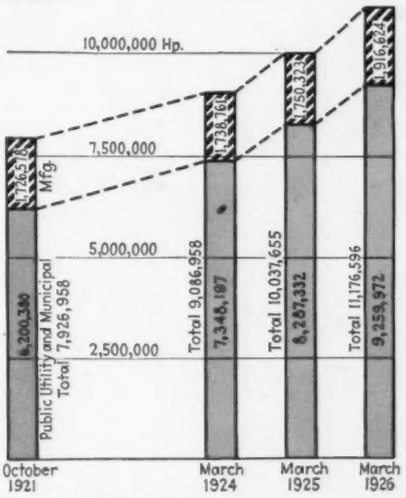
Moreover, in these more recently developed states, almost all the water power is used electrically; 97 per cent is definitely in hydro-electric central stations; even of the remaining 3 per cent in industrial plants only a portion finds direct application mechanically, without going through the electrical transformation.

Contrast that with the situation in New England, an old manufacturing region, where more than half of the developed water power belongs to manufacturing establishments. To these should be added the numerous plants of less than 100 hp., not included in this census, most of them driving small factories.

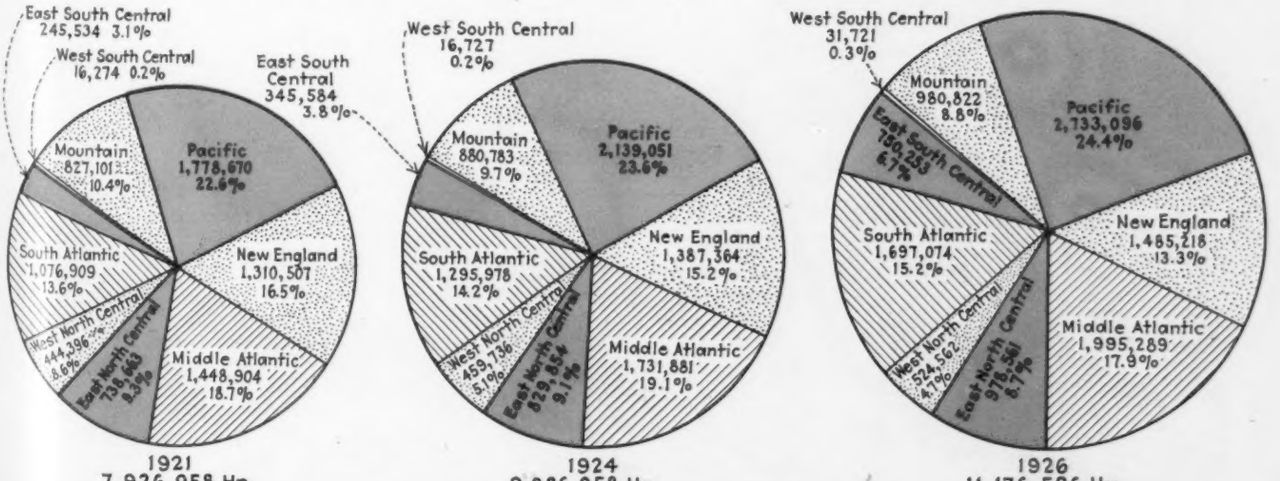
The comparison makes it evident that where industry is young, or where developments if made at all must be on a large scale, the electrical method has offered the only feasible means for harnessing our hydraulic resources.

This growth of three million horsepower in central stations in four and a half years represents a contribution to the cause of conservation of our national resources twice as great as the present developments at Niagara Falls.

Most of the data for statistics in the ELECTRICAL WORLD are gathered by it from original sources. Privilege is freely given to readers of the ELECTRICAL WORLD to quote for use these statistics for any legitimate purpose. While there is no requirement that the source of data be given, yet it would help the ELECTRICAL WORLD in obtaining and compiling further basic information if those who make use of these statistics would give credit to the ELECTRICAL WORLD.



Developed Water Power in the United States in Public Utility and Manufacturing Plants of 100 Hp. or More



Coast States Lead in Water-Power Development

Southern Industrial Activity on Level with Last Year

CONSUMPTION of electrical energy by the manufacturing plants in the Southern States indicates that activities in these plants during October were about of the same proportions as for industry in the country as a whole. In fact, the manufacturing plants of this section have followed national industrial operations very closely throughout the year. October activity in the manufacturing plants of the Southern States was slightly above that of September and also slightly above that of October of last year. The lumber, metals, fertilizer, paper, and stone, clay and glass industries all reported October operations over those of September, but the textile mills of the section reported operations slightly below those of September. October manufacturing activity in the section for industry as a whole was practically the same as that reported for October of last year and 12.4 per cent over the average monthly activity for the past three years. Such are the industrial conditions in the Southern States as indicated by data collected by the ELECTRICAL WORLD upon the electrical energy consumption of about 400 large manufacturing plants scattered throughout the section.

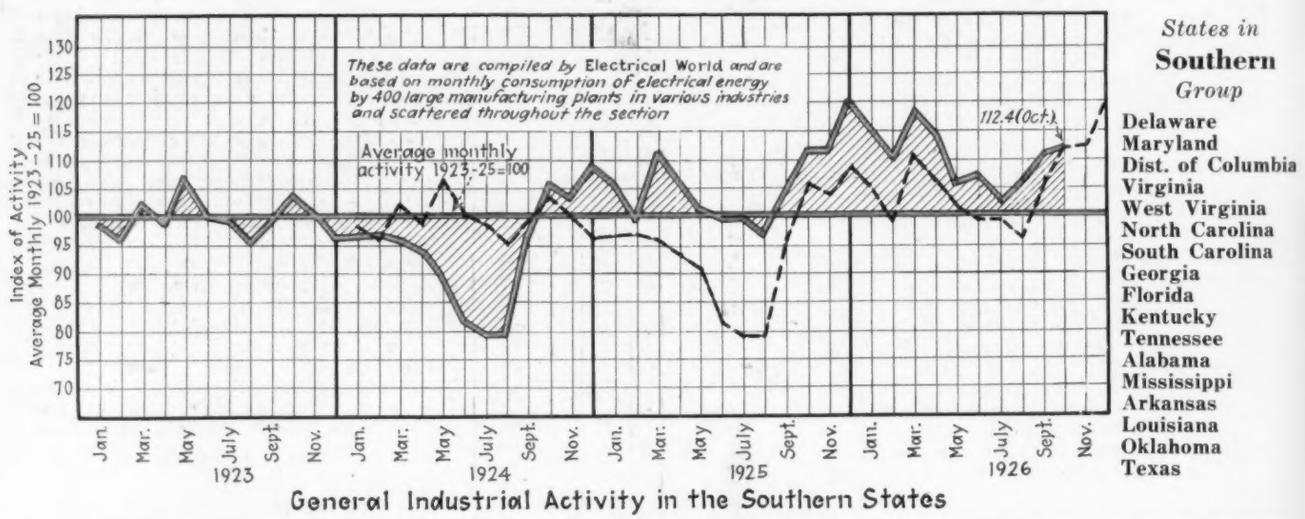
The textile industry, the backbone of Southern industry, reported October operations slightly under those of September, but 6 per cent above those of October last year. This downward turn in the operations of the textile plants of the Southern States is in direct contrast with textile operations in the country as a whole, in which October operations were materially above those of September. The rate of activity, however, for this section and the nation were about of the same order, indicating that during September the Southern cotton mills were operating in excess of the demand for cotton goods.

The lumber mills reported increased operations during October, but activity during the month was still about 14 per cent under October of last year. The high point in lumber-mill operations was recorded in March, following which a recession was experienced, the low point being reached in August. October operations were about 13 per cent over those of August.

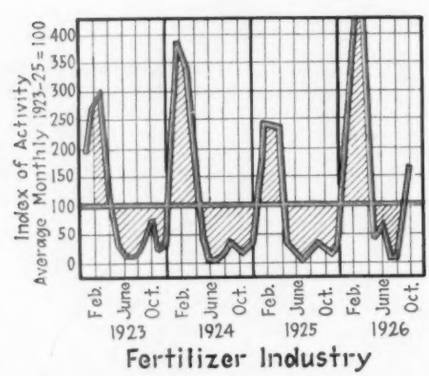
Operations in the metal industries continued high, October operations being about 35 per cent over October of last year. Operations during this month were about on a par with those of September. October operations in the paper and pulp mills were about 7 per cent under those of last year.

"Electrical World" Barometer of Industrial Activity in the Southern States

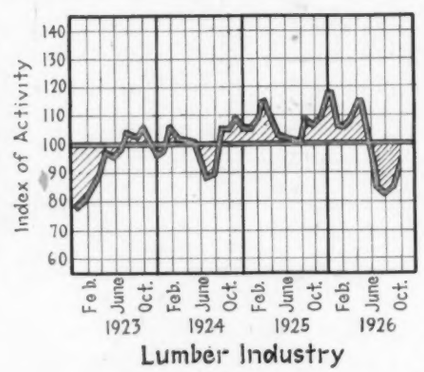
(Data Unadjusted for Seasonal Variation)


These data are compiled by Electrical World and are based on monthly consumption of electrical energy by 400 large manufacturing plants in various industries and scattered throughout the section
Average monthly activity 1923-25=100
112.4(Oct.)
Index of Activity Average Monthly 1923-25 = 100
130 125 120 115 110 105 100 95 90 85 80 75 70
Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov. Jan. Mar. May July Sept. Nov.
1923 1924 1925 1926
States in Southern Group
Delaware
Maryland
Dist. of Columbia
Virginia
West Virginia
North Carolina
South Carolina
Georgia
Florida
Kentucky
Tennessee
Alabama
Mississippi
Arkansas
Louisiana
Oklahoma
Texas

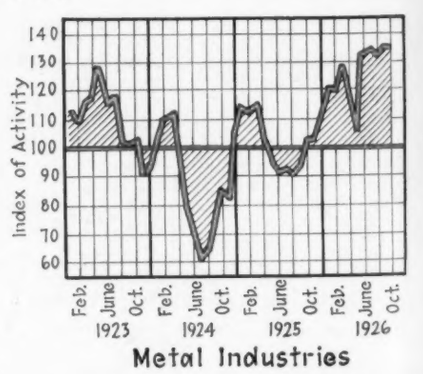
General Industrial Activity in the Southern States


Index of Activity Average Monthly 1923-25 = 100
400 350 300 250 200 150 100 50 0
Feb. June Oct. Feb. June Oct. Feb. June Oct. Feb. June Oct.
1923 1924 1925 1926

Fertilizer Industry



Lumber Industry

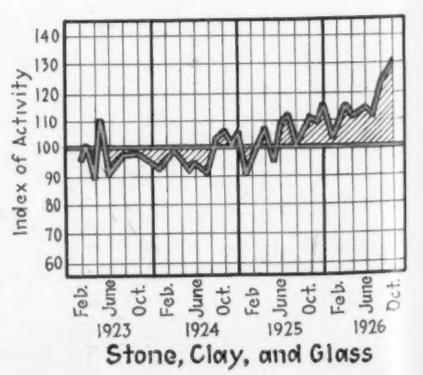


Metal Industries

Index of Activity Average Monthly 1923-25 = 100
140 130 120 110 100 90 80 70 60
Feb. June Oct. Feb. June Oct. Feb. June Oct. Feb. June Oct.
1923 1924 1925 1926

Paper Industry

Textiles Industry



Stone, Clay, and Glass